PUBLIC WORKS

July 1951

CITY, COUNTY AND STATE

½-million Yard Sanitary Fill

ommunications for Civil Defense

roblems in Making Rain in the West

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Walter M. Swietlik, Commissioner of Public Works of Milwaukee since 1940 and administrative head of eleven bureaus. More on page 24.

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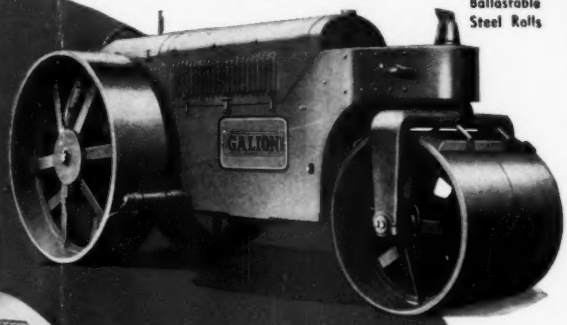

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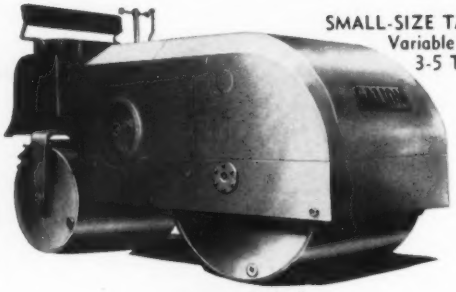

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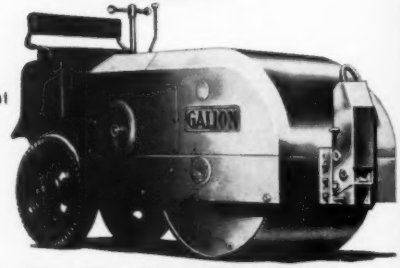

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Figure R 5556—Vertical Open Shaft Pump. For dry basin installations. Motor is mounted on floor above and connected to the Pump through shaft with Universal flexible couplings. See Bulletin 126.

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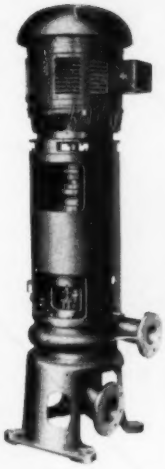

Figure R 5656—Vertical Pedestal Mounted Non-Clog Pump. See Bulletin 126.

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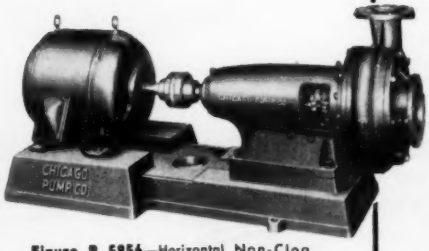

Figure R 5856—Horizontal Non-Clog Pump with direct electric motor drive. Described in Bulletin 127.

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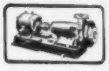

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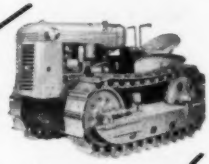
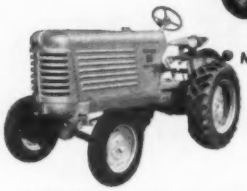
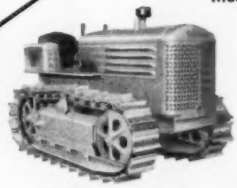


Model OC-3—22 h.p. Gas



Model "66"—27 h.p. Gas



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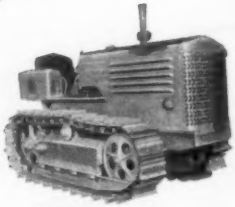
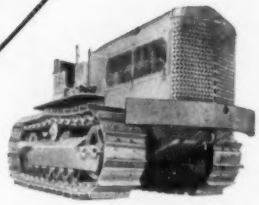
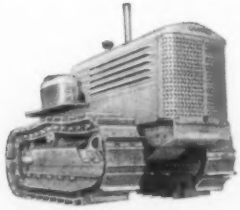


Model B—38 h.p.
Gas or Diesel



Model FDE—110 h.p. Diesel



Model D—61 h.p.
Gas or Diesel

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Magazine

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THE ENGINEERING AUTHORITY IN THE CITY-COUNTY FIELD

THE EDITOR'S PAGE

We Need Scrap Iron Now—and Lots of It

MORE scrap iron is needed right now to keep up with the demands of our steel mills. City and county engineers, water works superintendents and others in this same field of work can help a lot. There is old and unused equipment in every city and county shop and yard and in every water, sewage treatment and municipal power plant. This ought to be surveyed, collected and put to good use. Right now is the time to get started. And how about old bridges?

Scrap should be handled through normal channels. There is someone in your community who collects and passes on scrap for normal industrial use. The price for scrap is regulated and controlled by the Office of Price Stabilization, and it won't pay to hold out for higher prices later. Let's go.

It Will Take Courage to Solve These Housing Development Problems

IMPROPERLY engineered housing developments are proving serious problems in more ways than one. Paving, other utility and financial problems are often serious, but right now we want to talk about the problems arising from lack of adequate sewerage and drainage. After all, street surfaces can be laid or, in a pinch, the residents can bump through mudholes; water and gas lines can be brought in, or cooking can be done with oil or electricity; and even financial problems have a way of working out in time. But when people have moved in, the cesspool starts overflowing, and there is water in the cellar, something needs to be done right now. And usually there is very little that can be done that quickly.

Assuming a development within the city limits, the building department approves the plans for the building; the plumbing department the heating and plumbing; and someone from the fire department takes a look at the oil-burner; but no one approves the overall livability of the house. No one appears to worry about the soil conditions which may make the cesspool or septic tank a perpetual source of trouble to the homeowner and a danger to the health of the entire neighborhood—and this applies to both local health officials and that government agency which is charged with the approval of loans on such houses. In many cases, at least, their approval has not been realistic.

As a result, people with an income already budgeted to the point of cracking through the purchase of a home on a long-time mortgage plan, move in and shortly find that the place they bought is virtually unfit to live in. This results most often from inadequate cesspools or septic tanks, constructed in ground areas which should never be used for such purposes, or from a high water table that results in water in the cellar. In either case, no one can give any relief. The health officer can grouse about the cesspool situation, but if the ground is tight and waterlogged there is nothing the health officer, the purchaser or anyone else can do. The health officer or the owner, or both, can grouse about the water in the cellar, but what can be done? It is not even likely that the builder or seller can be ordered to provide adequate cesspool construction; and certainly he cannot be made to come back and install such underground drainage as will guarantee dry cellars.

There is only one answer to this problem. Every city must require that every development provide sewerage facilities, and that subsurface drainage be so constructed as to lower the normal water table below the cellar floors of all homes. Sewerage facilities should consist of a standard sewage collecting system discharging into the municipal system, either by gravity or by pumping; or by the provision of a separate and adequate sewage treatment plant. There are package type treatment plants available which have given excellent results for such installations, even for very small ones.

In those cases where soil conditions are so favorable as to justify their use, septic tanks or cesspools may be permitted—but not on any 50-ft. by 100-ft. lot. That is asking too much. There are standard tests for determining whether or not cesspools or septic tanks will be satisfactory. A post-hole auger will help determine where the water table lies. Both tests can be quickly and readily performed by an engineer.

Some will say that the cost of these require-

(*Please turn to page* 18)

Balance your street sweeping budget with MOBIL-SWEEPER

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Here is a completely new idea in dragshovels for trenching and related digging — the Bucyrus-Erie Hydrohoe. Every operating function is fully hydraulic — boom hoist, swing, dipper dig and dump, boom telescope, outrigger set and retract, and positive dirt ejector.

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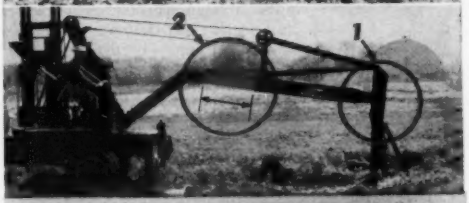

The Hydrohoe is the only dragshovel with two separate and distinct digging actions. The first is through a hydraulic ram located between boom and dipper handle. The second digging action comes from telescoping the boom. This exclusive telescope feature eliminates moving dragshovel back and forth when digging out boulders and excavating across pipe and cable . . . permits digging a level, scallop-free trench, greatly reducing hand trimming.

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If pipe is important to you . . .

you'll want to conserve its use. Here we show a few ways that will help you. You might like to check these operations against your own practices.

Because copper and red brass pipe is in short supply today, it behooves us all to use to the best advantage whatever materials are available, and employ them according to best accepted practices and keep them in service as long as possible.

Fig. 1. Cutting Pipe with 3-Wheel Cutters

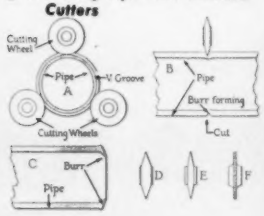


Fig. 2. Cutting with Hacksaw

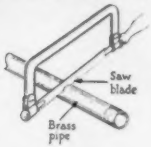


Fig. 3. Standard Pipe Thread

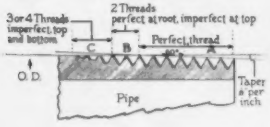
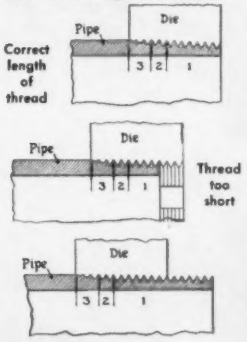


Fig. 4. Correct Length of Thread



Note these suggestions:

Cutting pipe with 3-wheel cutters (Fig. 1). At "A" pipe is about half cut through. At "B" a burr is forming. At "C" note how deeply burr extends into pipe thus reducing I.D. Produced by badly shaped cutter, like "D". Also too thick. "E" shows a superior cutter, which cuts thinner, easier and quicker, and leaves smaller burr. Thin blade wheel (shown at "F", with knurled instead of knife edge) does not spread metal apart, but makes clean square cut.

Cutting with hacksaw. Make cut few inches from vise to prevent vibration. Hold saw blade perpendicularly and at right angles to pipe horizontally. Improper cuts mean needless waste of pipe and time.

When threading pipe, pull tool easily and steadily; don't jerk or yank.

In running up dies, the most important thing is to know when to stop and reverse them. All threads must be run long enough to obtain 5 or more perfect threads to insure a thorough and full metal-to-metal contact when threads are screwed "home" in their fittings.

Reaming is necessary (Fig. 5). The pipe-end at "A" has a reamed edge with no interior projecting burr to interfere with flow. Pipe-end at "B" has heavy burr, which projects well into pipe, reducing its bore greatly, thus preventing delivery of water at full capacity. Burr should be reamed out.

Use proper wrench. In screwing up fitting on pipe or nipple, it is advisable to use monkey-wrench, which has smooth jaws. Never use a teeth-gripping wrench, whose teeth can cut into bands of fittings and reduce their strength.

Bending pipe. When it is necessary to bend pipe, either use softer material or soften the section to be formed by heating to a red heat. Bend a little at a time over rounded wood block, or anything round and soft. Do not bend over sharp edge, or pipe will kink.

Choose good pipe first. Care makes it last.

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Fig. 5. Avoiding a Burr

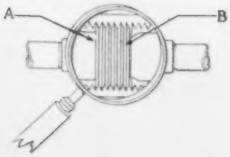


Fig. 6. Kind of Wrench to Use

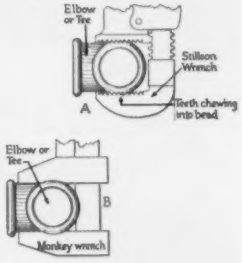


Fig. 7. Correct Screwing-up

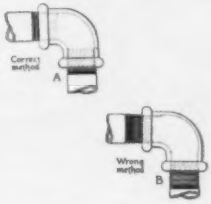
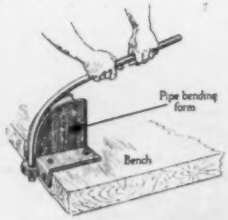


Fig. 8. Bending Pipe



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CRUSHES AND COMPACTS REFUSE—the powerful Crawler-Bullclam compacts the refuse—crushing, smashing, ironing it out with the specially curved Bullclam front.

TRANSPORTS AND SPREADS EARTH COVER—Every night the big red International covers the day's compressed garbage with a layer of clean earth, carried and spread in place by the big Bullclam bucket.

GRADES AND LEVELS FINISHED AREA—When the trench is full, a final earth layer two feet deep is graded and finished—and what once was wasteland is ready for park, playground or other municipal facility.

One operator reclaims land with an International Crawler-Drott Bullclam unit—the only equipment specifically designed to do all 4 steps of the complete sanitary fill job.

At Wood River, Illinois, garbage is disposed of and 30 acres of low land are being prepared for a park at the same time—and the whole job is done by one machine.

An International Crawler with a Drott Bullclam digs out trenches for the trucks to fill.

Then the Crawler-Bullclam tackles the refuse—compacting, compressing, crushing it flat with the specially curved Bullclam front.

Finally the Bullclam covers the compacted mass with earth and grades the earth smooth, to raise land values at the same time it raises the land itself.

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Need more facts about advertised products? Mail your Readers' Service card now.

New LOADER for Dump Trucks

The new Holmes-Owen truck loader is today reducing the cost of many jobs performed by contractors, states, counties, municipalities, industrial and commercial firms. The versatile one-man operation of this unit permits the truck driver to do his own light digging, grading, loading and cleaning up without the need for additional help or the use of more costly equipment. Loading is handled faster, and more efficiently for the driver can lift ½ yard per bucket and load the average truck in only 4 minutes. The loader equipment can be installed on most any 1½ to 2½ ton standard dump truck. It is easy to operate and profitable to use. Ask your equipment dealer for details or write factory direct.

ERNEST HOLMES CO., Chattanooga, Tenn.

MANY *Profitable* USES

There's nothing like a truck loader for the handling of stock pile materials. Doing light grading, cleaning-up and salvage operation, work on streets, highways, and contracting jobs. Has many practical industrial and commercial uses.

Manufactured by the makers of **HOLMES WRECKER EQUIPMENT**

Now's the time to mail this month's Readers' Service card.

ADOLPH ULMER, Jr.
Beaver Dam, Wisconsin

"I truck 8 tons of sand for less than 4½¢ a mile!"

Ulmer says, "On tough jobs my F-7 Ford Truck with POWER PILOT is economical, and I also get all the power I need."

Ulmer was one of 5,000 owners who entered the nationwide Ford Truck Economy Run. He kept daily running cost records on his 1950 Ford F-7 Dump and reports: "My truck traveled 18,955 miles in rough going with an average load of 16,000 lbs. My running cost expense amounted to $825.30 for gas, oil, maintenance and repairs—that's a running cost of only 4.35 cents a mile!"

Like others who rely on Ford for low running costs, Ulmer is sold on the periodic, money-saving service he got from his local Ford Dealer. For more facts on the trucks that last longer *and* save you money every mile—mail the coupon below.

FORD TRUCKING COSTS LESS

This new 145-h.p. Ford F-8 Big Job with special dump trailer has power reserves that construction men really appreciate! Tractor-trailer gross combination weight rating is 39,000 lbs.

because FORD TRUCKS LAST LONGER!

Using latest registration data on 7,318,000 trucks, life insurance experts prove Ford Trucks last longer!

POWER PILOT helps CONSTRUCTION MEN hold down hauling costs

The Ford Truck POWER PILOT is a simpler, fully-proven way of getting the most power from the least gas.

• It automatically meters and fires the right amount of gas, at precisely the right instant, to match constantly changing speed, load and power requirements.

Unlike conventional systems, the Power Pilot uses one control instead of two, yet is designed to synchronize firing twice as accurately.

You can use regular gas . . . you get no-knock performance. Only Ford in the low-price field gives you Power Pilot Economy!

MAIL THIS COUPON TODAY!

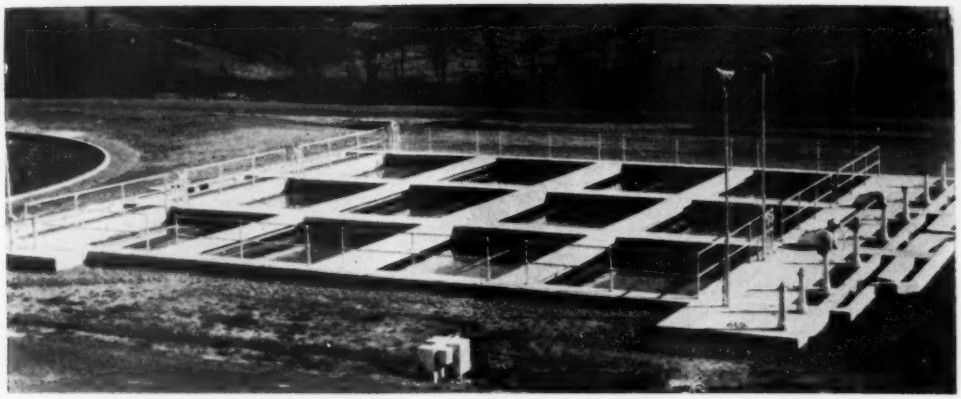
FORD Division of FORD MOTOR COMPANY
3257 Schaefer Rd., Dearborn, Mich.

Send me without charge or obligation, detail specifications on Ford Trucks for 1951.

Full Line ☐ **Heavy Duty Models** ☐
Light Models ☐ **Extra Heavy Duty Models** ☐

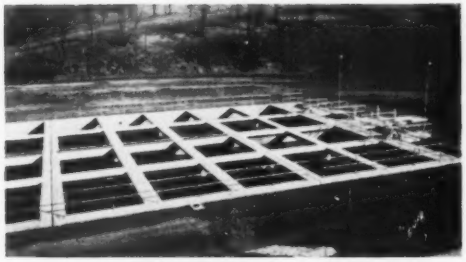
Name_____
(Please print plainly)
Address_____
City_____ Zone____ State_____

Get full details of this month's new products . . . mail your Readers' Service card today.

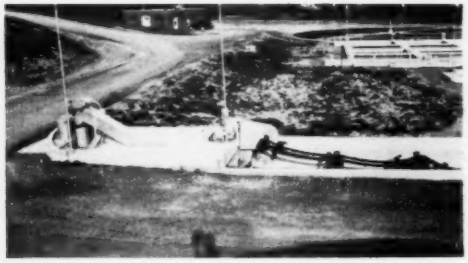


ROTOLINE SKIMMERS and Straightline Sludge Collectors in three 20 x 70 ft. primary settling tanks reduce suspended solids 59%, under actual operating conditions, in 1.76 hour detention time. Settling rate is 1220 gpd per sq. ft. tank area.

How to treat sewage for ¼¢ per day per capita



STRAIGHTLINE SLUDGE COLLECTORS — two longitudinal and one cross type — convey sludge to sumps in four 33 x 115 ft. final settling tanks. Peak-cap bearings, pivoted flights and "Straightline" action provide a positive, efficient combination.



STRAIGHTLINE GRIT COLLECTOR AND WASHER for 30 ft. grit chamber effectively collects, washes and removes settled grit — separates it from putrescible organic matter. Long-wearing Promal collector chain and rugged screw conveyor give low-cost long life.

LINK-BELT equipment plays prominent role at efficient Winchester, Va. sewage treatment plant

A PIONEER in Virginia's intensified pollution-abatement campaign, the city of Winchester recently placed in operation a 2.4 mgd Bio-filtration Plant. Designed by Alexander Potter Associates, consulting engineers, the plant is giving excellent sewage treatment at an operating cost of only ¼ cent per day per capita.

Major equipment used in this installation includes Link-Belt Straightline Sludge Collectors for all primary and final settling tanks, Rotoline Grease Skimmers and Straightline Grit Collector and Screw Conveyor-Washer.

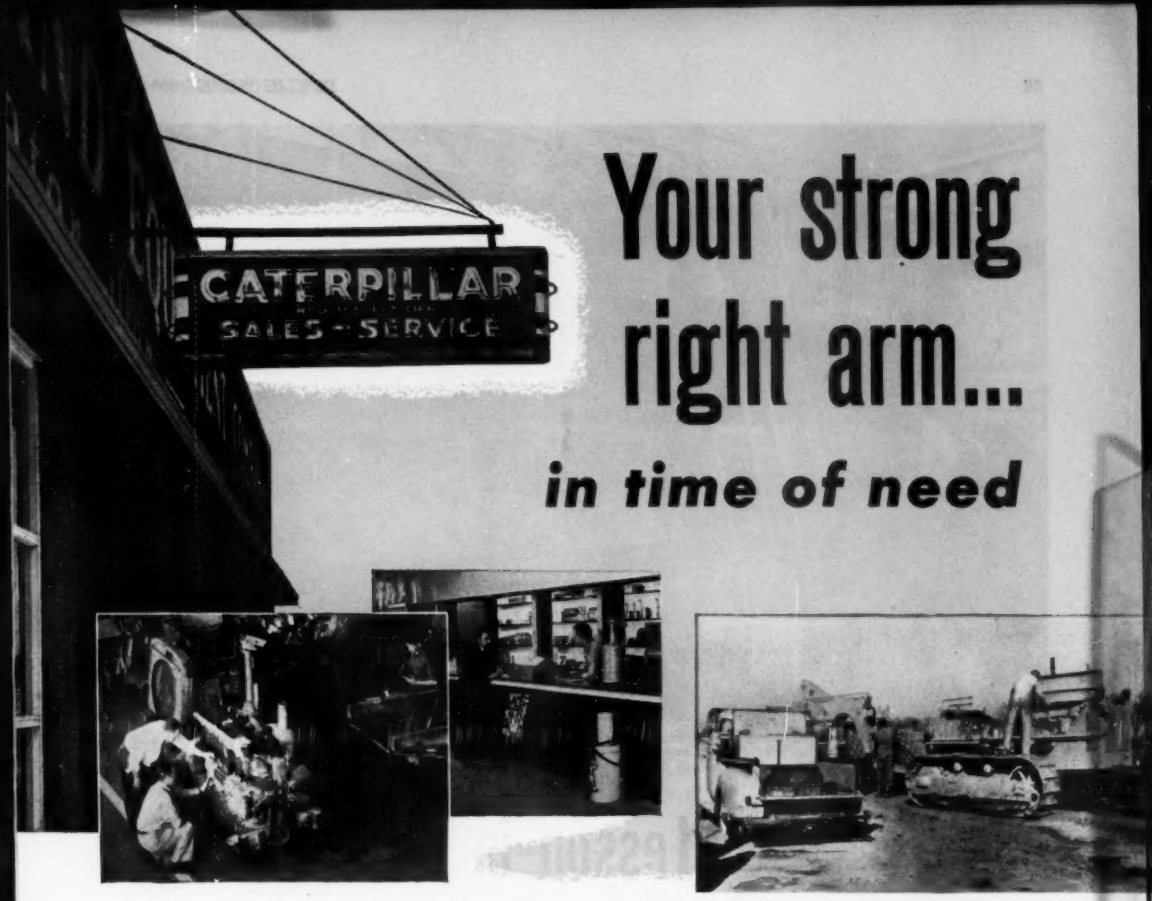
The complete L-B line is designed and built to highest standards and backed by more than 30 years' experience in this field. Link-Belt sanitary engineers will work with your engineers, chemists and consultants — help you get the best in modern liquid treatment.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12,538

Thousands use our Readers' Service card to keep up to date . . . do you?



Your strong right arm...

in time of need

BECAUSE of the vast defense mobilization program, material shortages and extra production demands have gripped the nation. They affect particularly the heavy industries and the distributors and users of their products. And huge as America's facilities have become in recent years, they still are not large enough to keep pace with military, civilian and non-federal government needs combined.

Nevertheless, as an owner of "Caterpillar" products, your county or municipality is fortunate . . . because "Cat" equipment has been built for long life and to withstand severe working conditions. What's more, it is backed by a dealer organization that is world-famous for experience, accessibility, mechanical facilities and field service to keep you going "come hell or high water."

Since World War II, the already large number of "Caterpillar" sales-and-service establishments has increased greatly. Also since that time, "Caterpillar" and its dealers have developed new techniques for restoring and extending the life of "Caterpillar" products. Today, in their own shops, "Caterpillar" dealers can *rebuild* a great many worn or damaged parts which formerly required completely new replacement. In short, every dealer is richly acquainted with scores of modern ways and means for keeping your machines in good working condition. You can help by doing this:

Take your maintenance problems to your "Caterpillar" dealer* BEFORE *parts are worn beyond repair

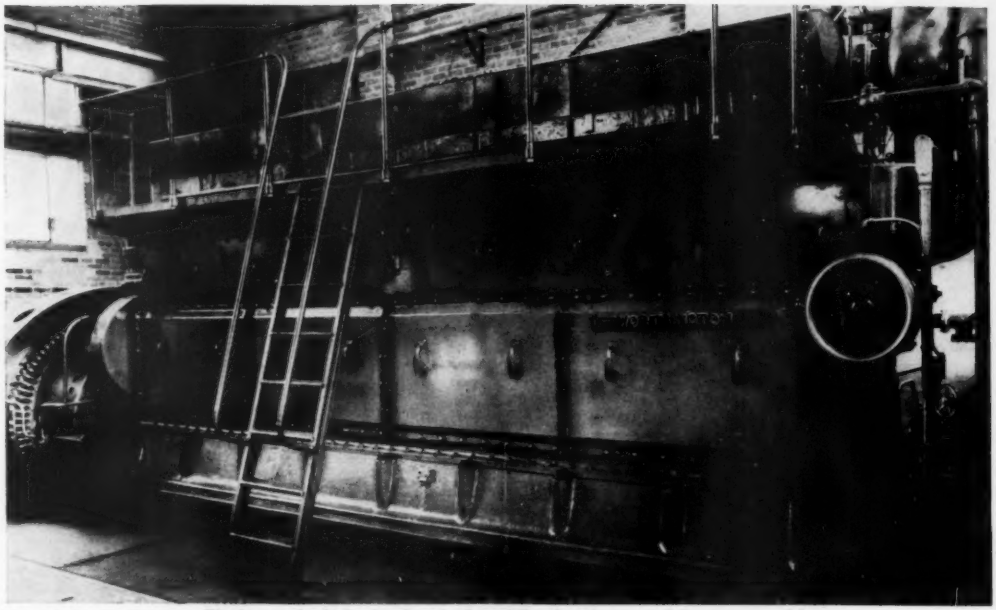
Remember that excessively worn parts can cause damage to mating parts; that track parts, pistons and liners, crankshafts, cylinder heads, radiators and other items usually can be salvaged. Your problems are your dealer's problems. Go see him today. He'll do everything in his power to keep your machines operating. Your combined efforts will be reflected in longer equipment life.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT



Worthington 8-cylinder 4-cycle turbo-charged Diesel engine—one of the two operated by Elko-Lamoille Power Company. This 1000 Kw-rated engine was installed on the same foundation originally built for an engine with 250-Kw rating.

Lesson in Cost Reduction

FROM THE MIDDLE OF THE DESERT

If you've never heard of Elko, you'll find this story interesting.

Elko is the seat of a county in Nevada that, all by itself, is larger than Massachusetts, Connecticut and Rhode Island together, with Delaware thrown in. Since pioneer days, it has been a transportation and trading center.

Elko's present power plant set-up, which includes two four-cycle turbo-charged Worthington Diesel engines connected to 1000-Kw generators, contrasts with the single 50-hp steam engine purchased second-hand in 1896 from a nearby silver mine.

Cost of power has never been more reasonable. Ever since 1940 when fuel oil cost this plant less than half what it does now, power rates have *gone down*—having been reduced twice during the period. Today, 87% of the power is produced by the two Worthington units, and in 1950 the plant averaged 13.3 Kw-hrs per gallon of fuel.

Lubricating oil consumption is low, too—well below the estimated 4,000 rated horsepower hours per gallon.

Want more evidence that there's *more worth in Worthington?* Write Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.

WORTHINGTON

E.I.19

ECONOMICAL CONTINUOUS POWER

Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 345 to 2640 hp

WORTHINGTON-BUILT AUXILIARIES

Balanced Angle Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Coolers

Shaker Heights PROFITS on Many Jobs

Take up, load out old pavement

Grade for street widening, parks

Backfill trenches

Load catch basin debris

Load all leaves and street scrapings

Remove ice and snow from streets

Load sand, cinders, salt, dirt

Feed concrete mixer in yard

Feed paper baler, load bales on trucks

Lift and carry snowplows, other equipment in yard and on jobs

Dig, strip, grade, load trucks

How does a city use PAYLOADERS? The Service Department of the city of Shaker Heights, Ohio, provides a good answer because it uses them in so many ways. This department has the task of maintaining, cleaning and clearing of 100 miles of paved streets, maintenance and landscaping of boulevards and parks, collection and disposal of all city leaves and paper. Their three PAYLOADERS take an important part in all these operations.

This versatility of PAYLOADER tractor-shovels for all sorts of digging, grading, loading and lifting work plus their ability to go where they're needed at speeds up to 20 miles an hour, has made them favorites with city, county and state public work departments. If PAYLOADER usefulness is not yet working for you, see your PAYLOADER Distributor or write The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Illinois.

Job Study No. 19 —

This picture-and-word report on how the city of Shaker Heights uses its PAYLOADERS is available on request.

SAY HUFF

PAYLOADER®

THE FRANK G. HOUGH COMPANY . . . SINCE 1920

Now's the time to mail this month's Readers' Service card.

TENNESSEE CORPORATION
Ferri-Floc
FERRIC SULPHATE

TURBIDITY

Ferric Salts have proven their ability to coagulate water of widely varying turbidity. Spring rains will bring about turbidity for those who must treat surface supplies. The use of Ferri-Floc will simplify the treatment of this high turbidity. Ferri-Floc is a partially hydrated Ferric Sulphate that has the ability to convert these high turbidities withou radical dosage changes.

A large filration plant superintendent has this to say, "For coagulation of high turbidity with a high PH we have found ferric sulphate to be superior in all cases and we would not hesitate to recommend it."

SULPHUR-DIOXIDE
HIGHEST QUALITY
SO_2

Sulphur Dioxide is effectively used in water treatment to remove objectionable odors remaining after purification.

TENNESSEE CORPORATION

EDITORIALS

from page 6

ments will unduly increase the cost of the property so that housing will be denied many who wish to own their own homes. This is baloney; if the house isn't fit to live in as it is, and the buyer is going to have to stand for sewerage and drainage later, he might better have the bad news right away. Also, the cost and the interest rate will be lower, if included in the mortgage, than it will if done by assessment later.

Who will have the courage to take a definite and forward step in correcting this scandalous situation? It looks to us as though the health departments, local and state, are the only ones with adequate power to force the issue, but they will need help from other city departments, notably the city engineer and, of course, the local council and the mayor. It is a big enough job for them all. Will they do it?

Utilizing Professional Skills in Municipal Work

INCREASINGLY, as the experience of our municipalities indicate the values of professionally trained men, there is a trend toward the broader use of professional skills. Instead of having an untrained man in charge of street work; another in charge of water supply; a third in charge of sewers and sewage treatment; and perhaps still another in charge of refuse collection and disposal, the modern trend is to combine two or more of these duties under a well trained and capable engineer.

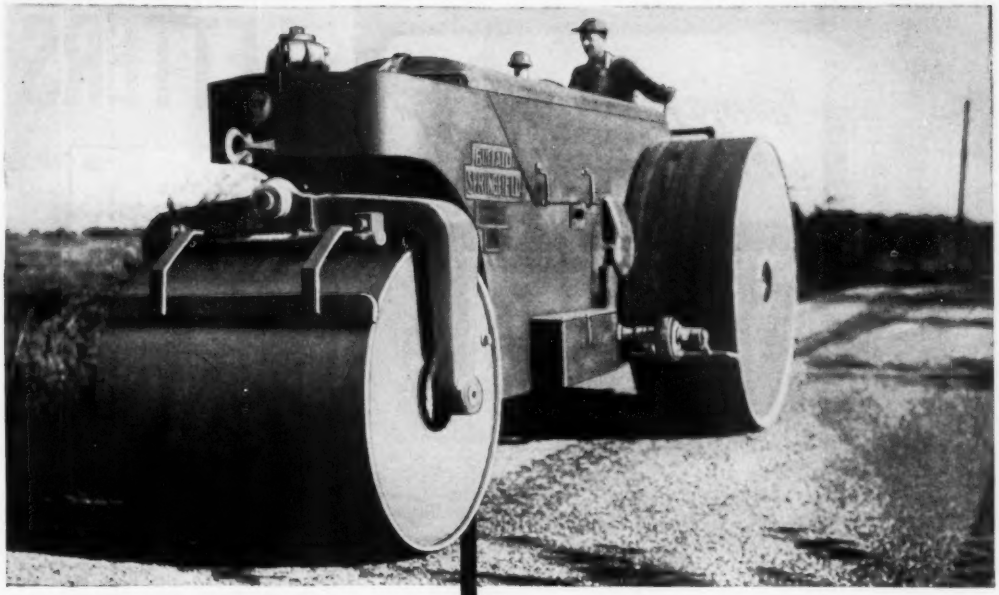
This is sound and reasonable practice. The smaller municipality cannot afford to have three or four engineers on its payroll; or does it need to have them. A consolidation of the various jobs requiring technical and professional skills and experiences provides the community with one well qualified man to oversee and direct all of the work of this nature. Doing this is the first step toward more efficient municipal operation.

Costs of Municipal Refuse Collection and Disposal

Rubbish is collected and disposed of by the municipality in Newton, Mass., but garbage collection is by contract. During 1950, the average cost of collecting rubbish was $7.67 per ton (as compared to $7.42 in 1949) and the costs of incineration were $2.53 per ton, unchanged from 1949. Total collections were 26,287 tons, of which 19,878 tons were incinerated. During the latter part of the year, careful records were kept of the work accomplished with two new packer type bodies. Each of these units were able to do as much work as two open type bodies, with a considerable mileage saving. Purchase of 15 additional rubbish collection bodies of this type has been recommended for the coming year.

The cost for garbage collection in 1950 was $10.65 per ton, for 8,315 tons, compared to $11.71 per ton and 7,566 tons in 1949.

Get full details of this month's new products . . . mail your Readers' Service card today.



WORKHORSE
3-Wheel Roller Style

Buffalo-Springfield variable weight 3-wheel rollers are work-horses by any definition. No longer single-purpose machines, these new units far outstrip "old Dobbin" in ability to perform many different jobs with efficiency and economy.

For example, the Buffalo-Springfield model VM-18 is basically a 5-ton machine—but that's not all. It can perform work calling for a 6-ton or even a 7-ton machine. The VM-18's wide job versatility is made possible by ballast type rolls. Heavy steel head plates, welded to the roll tires and hubs, form water-tight compartments. Filling and drain plugs in the outer heads permit filing the rolls with water to increase the roller weight. If even higher compressions are desired, shovel openings with bolted water-tight covers are provided so a mixture of water and sand can be used as the ballasting material. Thus—the VM-18 can be adapted to meet compression requirements that would *normally* call for three fixed capacity models.

Equally important, the roll surfaces are machine-finished for uniform smoothness and curvature, which means the VM-18 can also be used for finishing work. Thus, one variable weight 3-wheel roller is used for many applications and reduces the equipment requirements on any road building job.

There are seven Buffalo-Springfield variable weight models covering a range from 5 to 17 tons. Your nearest distributor can give you complete details on the model best suited to your needs. See him today.

BUFFALO SPRINGFIELD
THE STANDARD OF COMPARISON
SPRINGFIELD, OHIO

MAIL THIS COUPON TODAY

THE BUFFALO-SPRINGFIELD ROLLER CO.
Dept. Q7, Springfield, Ohio

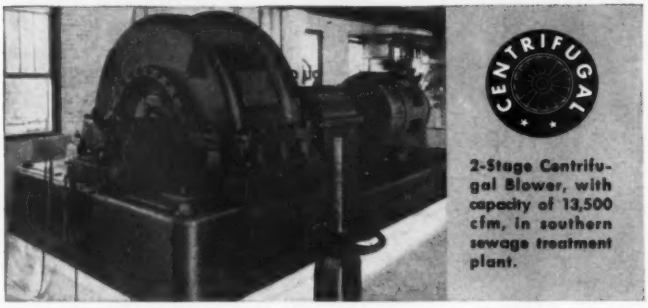
☐ Please send me Catalog S-60-30 describing the right model for my requirements. ☐ Notify Distributor to call.

NAME .....

ADDRESS .....

CITY ..... STATE .....

Thousands use our Readers' Service card to keep up to date . . . do you?



CENTRIFUGAL

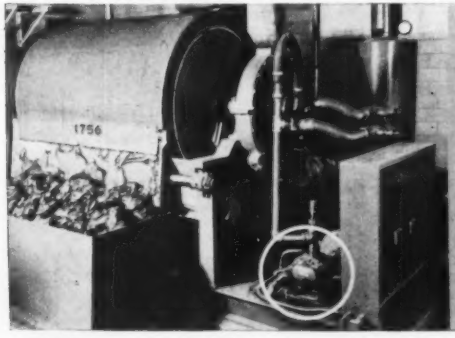
2-Stage Centrifugal Blower, with capacity of 13,500 cfm, in southern sewage treatment plant.

The superintendent of a large sewage treatment plant made this friendly statement to a Roots-Connersville representative. What he really meant was that R-C Blowers and related equipment perform so satisfactorily and dependably that they seldom need anything more than routine inspection by his own men.

In large and small plants—for metropolitan areas, rural villages or industrial sewage treatment—R-C products uniformly give this kind of reliable operation. They continue to deliver rated capacities, year after year, with a minimum of maintenance—whether a small Rotary Positive Blower of 5 cfm capacity or a Centrifugal unit moving up to 100,000 cfm.

If you are planning a new plant, expansion, or replacements, R-C engineers will work with you to select the equipment best fitted to your needs. Almost a century of experience is at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Poplar Avenue, Connersville, Indiana



ROTARY

Small Rotary Positive Blower used for blowing cake off a drum filter.

ROOTS-CONNERSVILLE
ONE OF THE DRESSER INDUSTRIES

BLOWER BUILDERS SINCE 1854

It's a fact . . . our handy Readers' Service card is the easy way to get new catalogs.

LETTERS TO THE Editor

THANKS A LOT

Color and decorative pieces for an office always tend to make a day brighter. We are sending you a true-scale model of our HD-5 tractor which we believe will add color and attractiveness to your office.

J. M. Bratcher,
Tractor Division,
Allis-Chalmers Mfg. Co.
Milwaukee, Wisc.

(This model certainly attracts the attention of every visitor to my office and has occasioned many favorable comments. It is a beautiful piece of work. Ed.)

TIME FOR PUBLIC WORKS

Your editorial—"There is no Better Time than the Present for Public Works Construction"—is a cogent statement of what is needed. Your message is one that needs repeating over and over again.

E. J. Cleary,
Ohio River Valley,
Water San. Comm.,
Cincinnati, Ohio.

Congratulations on your forthright editorial "There is No Better Time Than the Present for Public Works Construction" which appeared in the May, 1951, Public Works.

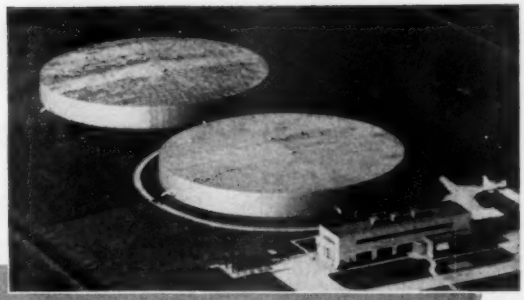
Seth G. Hess,
Dir. & Chief Engr.,
Interstate San. Comm.,
New York, N. Y.

TYPICAL OF MANY

Our office has noted with interest the basic information in your April issue on Civil Defense. We feel that every Department Head in our organization should be familiar with the entire edition and for this reason we would like to get 12 copies of the same.

George W. Lubke, Jr.,
Director, Civil Defense,
Halifax Area,
Daytona Beach, Fla.

Right: Twin 5,000,000-gallon Horton reservoirs built several years ago for the City of Houston. Both are of welded steel construction.



HOUSTON ALWAYS DOES THINGS IN A BIG WAY

When booming Houston, Texas, undertakes to do anything, you can be sure it will be done in the biggest and best way possible.

Here's their solution to city water shortages.

Two current situations could have resulted in water shortages in Houston: (1) the general lowering of the continental water level, and (2) the unusually rapid increase in population. Alert planning has, however, kept pace with both these conditions. Recently, three Horton reservoirs with a total capacity of 15,000,000 gallons were added to its water distribution system.

This giant reserve of water helps supply the daily needs of Houston today — and will continue to do so for years to come — for the reservoirs are of welded steel construction. They won't develop cracks or leaks — and regular painting will keep them good as new.

Many cities depend on Horton reservoirs to solve large-capacity water storage problems. These structures are built in sizes up to 10,000,000 gallons. Write for more details.

5,000,000-gallon reservoir in the Houston water distribution system is 210 ft. in diam. by 20 ft.

Steel for a Fourth Houston Reservoir Treated by Phoscote Process

The Phoscote process is an efficient, economical means of removing mill scale from steel. It also provides a clean, dry surface with a coating that improves the bond between paint and steel. A prime coat of special paint is applied while the steel is still warm. The result is greatly reduced maintenance and longer tank life.

HORTON

WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

Atlanta 3.....2123 Healey Bldg.	Los Angeles 17..1508 General Petroleum Bldg.
Birmingham 1.....1532 North Fiftieth St.	New York 6.....3316—165 Broadway Bldg.
Boston 10.....1038—201 Devonshire St.	Philadelphia 3...1648—1700 Walnut St., Bldg.
Chicago 4 .....2115 McCormick Bldg.	Salt Lake City 4.....539 West 17th South St.
Cleveland 14.....2221 Guildhall Bldg.	San Francisco 4.....1525—200 Bush St.
Detroit 26.....1536 Lafayette Bldg.	Seattle 1.....1339 Henry Bldg.
Havana.....402 Abreu Bldg.	Tulsa 3.....1641 Hunt Bldg.
Houston 2.....2142 National Standard Bldg.	Washington 6, D. C.....1120 Cafritz Bldg.

Need more facts about advertised products? Mail your Reader's Service card now.

CLEVELANDS

Engineered for

TOP PERFORMANCE

on ALL the trenching jobs

Continual engineering advances based on many CLEVELAND-pioneered principles lie behind the famous CLEVELAND versatility and efficiency that mean dependable schedule-beating performance on all your trench excavation . . . drainage—irrigation—cable and conduit—footings and foundations—utility main extensions and services—pipelines large and small. This means rugged trouble-free power and strength for the toughest off-season digging without sacrificing the light weight that gives high flotation and quick mobility between jobs . . . without sacrificing the perfect balance and compact size that allow easy maneuvering in the tightest places . . . without sacrificing CLEVELANDS higher cutting capacity and wide range of trench sizes. Get complete specifications and performance data from your local distributor today.

THE CLEVELAND TRENCHER CO.
20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Now's the time to mail this month's Readers' Service card.

BOOKS IN BRIEF

ATOMIC ATTACK SURVIVAL

This is a much improved edition of the U. S. Government publication "Survival Under Atomic Attack." Permission was obtained to use the original copy, while highly appropriate illustrations and an effective layout were supplied by the Biddle Co. of Bloomington, Ill. Publication is by Trail Blazers Publishing Co., Kewanee, Ill. As a means of stimulating interest in civil defense and of educating the public, these booklets could be mailed out with water bills or otherwise distributed. 16 pp. $20 per thousand from the publisher.

ARCHITECTURAL STANDARDS

This is the fourth edition of a magnificent book which gives engineers, draftsmen, architects and builders the standards, facts and data they need to deal with every phase of building. There are 566 plates showing detail drawings. Whenever possible, related material will be found on facing pages. In any drafting office, this book will save a lot of time. There are 566 pages. By Charles G. Ramsey and Harold R. Sleeper. Published by John Wiley & Sons, Inc., New York; $10.

TRANSPORTATION

This is a background book that a good many engineers ought to read thoughtfully. Part I is devoted to the general importance of transportation; Part II outlines the traffic pattern of the US; discusses the business organization for providing transportation services; and goes on to cover freight and passenger transportation, technological progress, terminals, urban factors and highways. Part III is mostly rate-making; Part IV is devoted to regulation; Part V to special transport problems; and Part VI is perhaps a preview of the future. By Charles E. Landon, Duke University; published by William Sloane Associates, Inc., New York; 600 pp.; $4.75.

YOU TAKE IT OUT

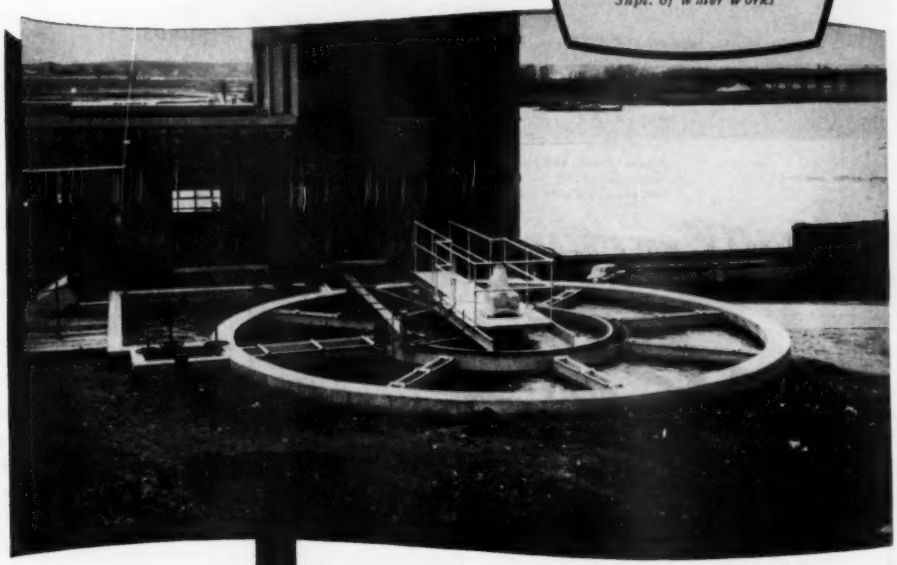
This is an educational bulletin published by the Indiana State Board of Health. Excellently pre-

with the **Accelator®**

Chester, Illinois, no longer needs

2-hour presedimentation basin...

"I'd rather have an extra Accelator in place of the basin."
– says **HERMAN WELTON**
Supt. of Water Works



CLEARER WATER FASTER
with exclusive slurry recirculation
SAVE UP TO 80%
in space (with lower construction costs)
SIMPLER OPERATION
– mixing, coagulation, clarification and sludge removal all in one unit
FASTER CHEMICAL REACTION
HIGH RATINGS

This Infilco plant at Chester, Illinois, handles 2,000,000 g.p.d. of Mississippi River water ranging from 400 to 4000 p.p.m. turbidity. The Accelator produces an effluent of 2 to 12 p.p.m. and is so efficient that a 2-hour presedimentation basin is no longer needed and has been taken out of service.

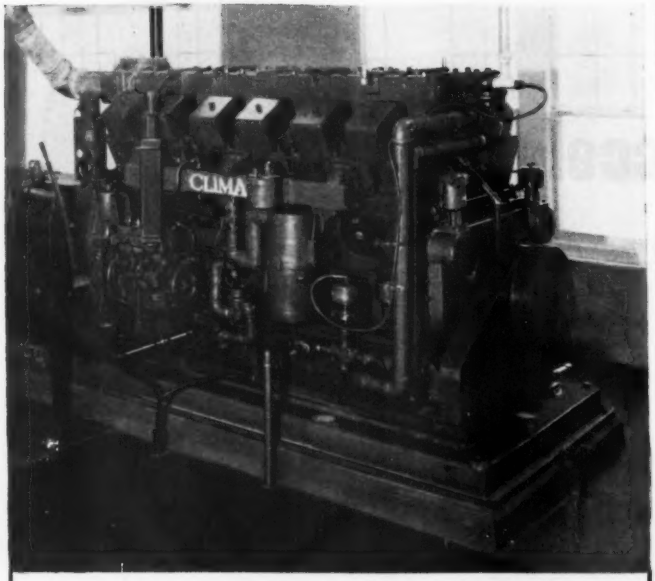
INFILCO
BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894

INFILCO INCORPORATED | *Tucson, Arizona*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

World's Leading Manufacturers of Water Conditioning and Waste-Treating Equipment

Get full details of this month's new products . . . mail your Readers' Service card today.



Climax V-120, 12 Cylinder, Natural Gas Engine @ 900 RPM, direct connected to centrifugal pump requiring 340 H.P. Installed in Water Works, City of Fort Worth, Texas.

climax BLUE STREAK ENGINES

FOR STANDBY OR CONTINUOUS SERVICE

FOUR Climax Blue Streak engines are installed in the Fort Worth Water Works for dependable standby service in case of failure of normal power supply. These engines are on the job constantly to protect Fort Worth citizens by maintaining dependable fire protection and lowering insurance rates. They are used during peak load periods to supplement the motor driven pumps which would otherwise be overloaded or require additional units.

Write for complete information and specifications. There are 4, 6, 8 and 12 cylinder engines, rated from 40 to 600 H.P., operating on natural gas, Butane or gasoline. For operation on sewage gas, engines available in sizes from 40 to 250 H.P.

climax ENGINE AND PUMP MFG. CO.

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pared, it stresses the need for better collection of refuse, including the use of modern equipment; and the need for proper disposal by sanitary landfill, garbage grinders or incineration. 16 pp. Bulletin SE 12.

NJ SOIL SURVEY

An excellent report on New Jersey soils, this publication is of a general nature indicating the soil environment and the research procedures that have been followed. This report: "Engineering Soil Survey of New Jersey, Report No. 1" will be followed by county reports. Bureau of Engineering Research, Rutgers University, New Brunswick, N. J.

TOLL ROADS

Some forty years ago this country said farewell to toll roads forever, most people thought. Now they have suddenly revived in the automotive setting of today. This revival is due to the current inability of highway administrations to cope with the demands and the traffic needs of today. This book analyzes the problems and indicates ways in which toll financing may best be integrated into a sound solution of our problems. By Wilfred Owen and Charles L. Dearing; published by Brookings Institution, Washington, D. C.; 196 pp.; $2.50.

LEADERS IN THE PUBLIC WORKS FIELD

Walter M. Swietlik, Commissioner of Public Works of the City of Milwaukee, Wis., was graduated from Wisconsin University back in 1916 with the degree of Bachelor of Science in Civil Engineering. He has been in his present position, responsible for the administration of Milwaukee's public works, since 1940, acting as administrative head of eleven Bureaus in the Department of Public Works.

He is a member of the American Public Works Association, the Engineers' Society of Milwaukee and the National Institute of Governmental Purchasing. He is single. He likes bowling, golfing and fishing, but in late years has not had the time available to enjoy these.

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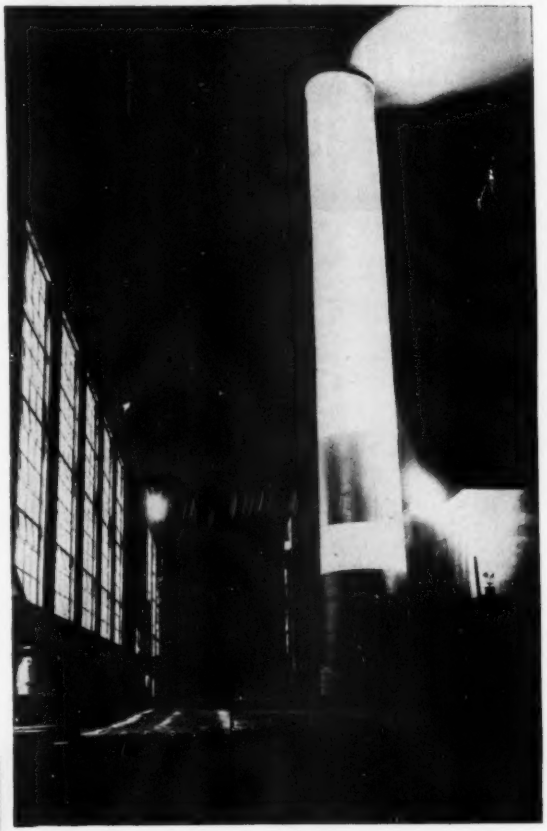

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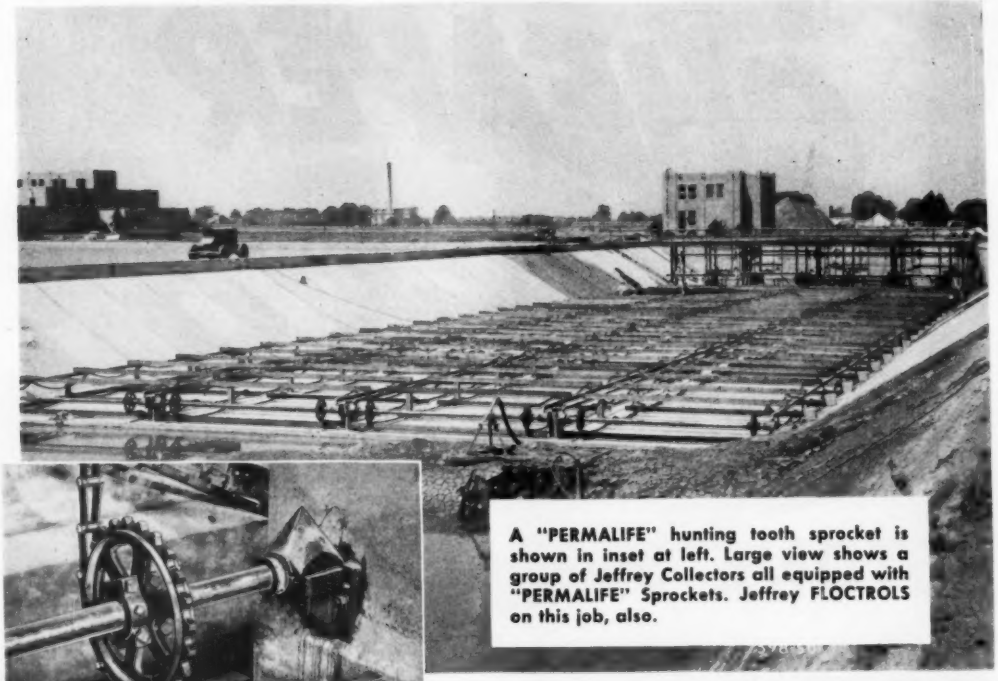

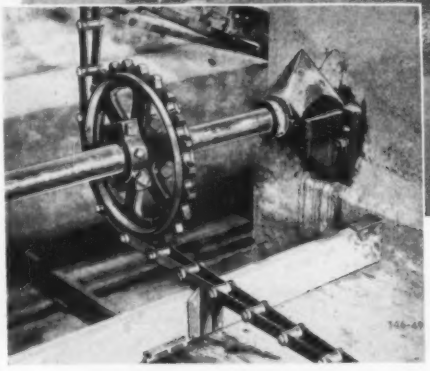

A "PERMALIFE" hunting tooth sprocket is shown in inset at left. Large view shows a group of Jeffrey Collectors all equipped with "PERMALIFE" Sprockets. Jeffrey FLOCTROLS on this job, also.

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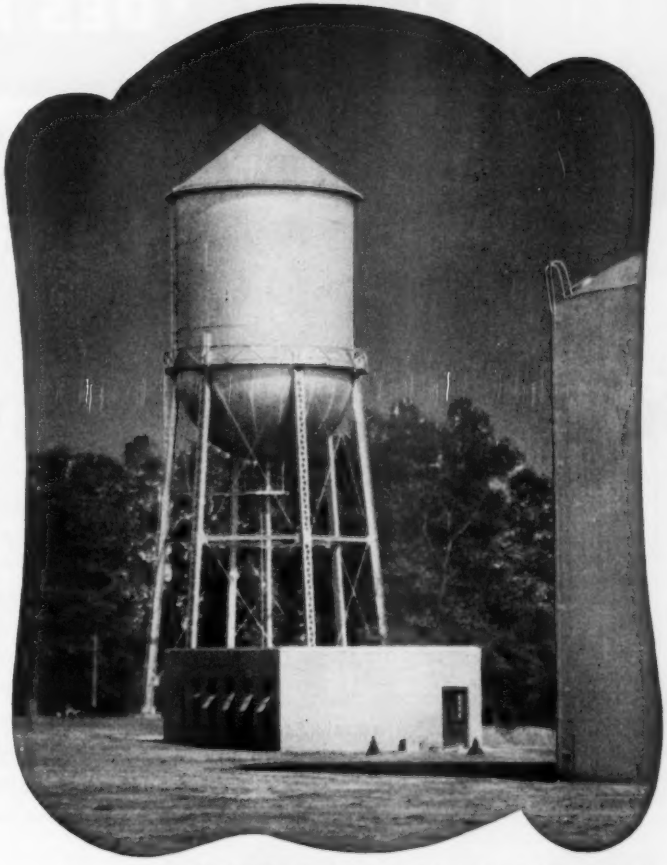
The answer was as usual with all Layne water supply equipment. Congratulations to Nacogdoches for continued use of the world's finest wells and pumps.



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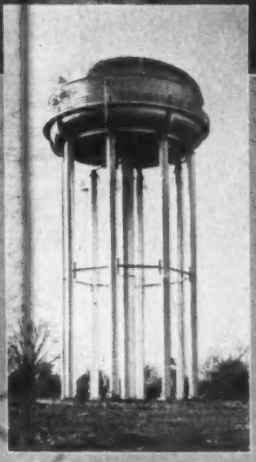

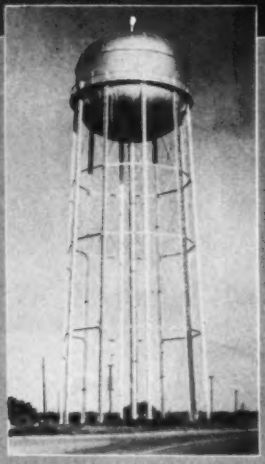

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PUBLIC WORKS Magazine

JULY 1951 VOL. 82 • NO. 7

COMMUNICATIONS NETWORK FOR CIVIL DEFENSE

NEAL F. HARMON,
Civil Defense Coordinator,
Electronics Department,
General Electric Company,
Syracuse, New York

• ***POLICE headquarters is tied into the CD communications system.***

INADEQUATE communications facilities, or the failure properly to coordinate existing systems and to provide for standby methods, will multiply the problems of local government and civil defense authorities in the event of enemy attacks on the United States.

Communications are truly the nerve center of civil defense. This applies particularly in the primary target areas of the country, but also in other communities where sabotage will serve the enemy in the course of our current preparedness program, or in the event of war.

The Civil Defense Administration of Onondaga County, N. Y., has launched a communications program designed (1) to solve the problem of coordination and (2) to provide auxiliary facilities which can be put into operation for all existing two-way radio systems in the county, should any or all of these systems be put out of commission by sabotage, bombing attacks, power failures, etc.

The Onondaga Plan

This article explains the Onondaga Plan which has been worked out with the assistance of General Electric's Civil Defense Communications Advisory Service. Local authorities believe the program will serve as a model for other communities.

The first step was to make a survey of all local two-way radio systems. This was done with the form shown in Figure 1 as a guide.

The survey revealed 13 services operating on 19 frequencies. These are the New York State Police; Syracuse police; Village of Solvay police; Syracuse Fire Department; Onondaga County Highway Department; telephone company mobile telephone subscribers; electric power company; a construction company; and five taxicab companies on four frequencies. The County Sheriff's

DATE _____

COMMUNICATION EQUIPMENT SURVEY
CIVIL DEFENSE

MADE FOR _____

DEPARTMENT	FREQUENCIES		NUMBER OF VEHICLES RADIO EQUIPPED	NUMBER OF VEHICLES NOT RADIO EQUIPPED	FIXED STATION STANDBY POWER
	TALK OUT	TALK BACK			
Police, City of					
Police, City of					
Police, County of					
Fire, City of					
Public Utilities					
Highway Department					
Taxi Companies					
State Police					

Suggested Coordinating Frequency _____ now being used by _____

Communication Coordinator _____

Address _____

Remarks MADE BY _____

● *FIG. 1. The type of form used for surveying all two-way radio systems in Onondaga County.*

● *TWO-Way radio serves in peace-time, also. It was invaluable in last winter's severe storm.*

Department shares the transmitting facilities and frequencies of the Syracuse Police Department. Seven of the services employ two-frequency operation wherein mobile units transmit on a separate frequency from the main station transmitter. The 13 services operate more than 400 mobile units throughout the county.

Civil Defense Authorities will maintain only supervisory control over the various services unless forced to take over for them because of loss of radio equipment, power or personnel. The CD "center" must therefore be able to operate (1) as a mobile unit on any of the service frequencies: (2) as an auxiliary fixed station for any or all of the services should the need arise; and (3) as a station from which to supervise and coordinate the entire system.

How It Will Work

The "center" will be equipped with transmitters and receivers for each of the services. Seven of the transmitters will employ two-frequency operation. Further, the center includes a transmitter on a separate frequency for transmitting supervisory and coordinating messages; and a transmitter and receiver covering the amateur radio frequencies.

Present plans call for the communications center to be located in a large trailer (motor truck line type). Several remote locations will be established with provisions for tying into telephone and power lines. To guard against possible sabotage, the "center" will be moved from time to time, and it will not be identified (an advantage over a fixed location). In addition to power connections at the established points, the trailer will be equipped with a gasoline driven, 110-volt AC 10,000-watt generator.

It will be possible to operate all of the center's transmitters, and to monitor transmissions from all of the coordinated services, from any one of several operating desks. Interlocks will prevent operation interference between desks.

With light traffic, one operator can perform all functions of monitoring, transmitting, and coordination. As the traffic increases, portions of it can be taken over by one or more additional operators at the other control desks. The division of duties can be predetermined to avoid confusion.

Each operating desk will be equipped with proper switches and relays to permit operation of all facilities. This plan affords maximum flexibility of control with a minimum of equipment.

Transmissions from the "center" on the coordinating frequency will be received at the 13 services by means of an inexpensive receiver employing selective dispatch. The receiver to be used here is the new General Electric Civil Defender.

The Civil Defenders will be activated from the "center" by means of tone-operated selective dispatch. They will, therefore, remain silent except to receive alerts and instructions from the center directed especially to them.

Tone-operated switches can be incorporated in these receivers. These allow warning and all-clear sirens to be controlled directly from the trailer "center." This will be extremely advantageous because the center will receive alerts via the state-wide Attack Warning radio system.

Stand-by Power Facilities

The 13 services are being encouraged to provide standby power equipment at their main transmitting stations. In addition, those services employing two-frequency operation, are being asked to provide at least one of their mobile units with proper equipment to permit it to serve as an auxiliary dispatch station; that is, these units will be equipped to transmit and receive on both frequencies. Services operating on a single frequency need not alter a mobile unit to accomplish this but should have one

mobile unit designated as an auxiliary dispatch station. Therefore, under this plan, each service will have dispatching facilities in depth. The first will be normal operation on regular power, then normal operation on standby power, (gasoline driven generator) an auxiliary station in a mobile unit, and finally the trailer communications center, to take over in case of failure of all three.

When an alert is received, the operators will go to the trailer, whose location will be known to them at all times. They will monitor the various services to determine if all have received the alert and coordinate the alerting that remains to be done. All alerting and general instructions will be transmitted on the coordinating frequency, and received by the Civil Defenders at the various dispatching points. These transmissions will be kept at a minimum, as will transmissions on all frequencies. The primary consideration will be to allow the various services to continue their own dispatching so long as they are able to do so in accordance with the established plan set forth by Civil Defense Authorities.

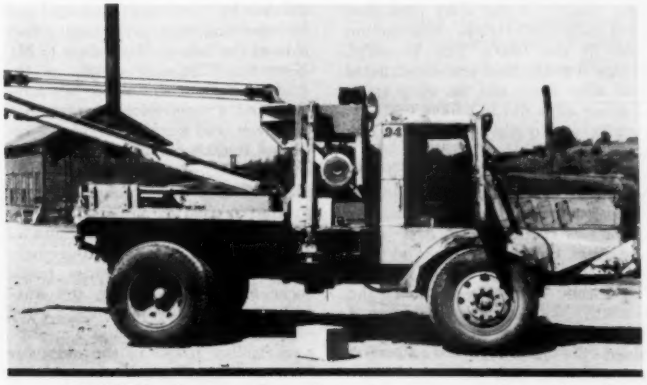
Following the dropping of bombs, or other disaster, the trailer "center" will be moved to a location nearer the scene, or to another advantageous site previously determined. It will be moved by one of the tractors offered by local trucking companies.

Installation of much of the equipment for this system is currently under way. The entire system is scheduled for completion by mid-August.

● ***COUNTY highway department is also tied into the CD system.***

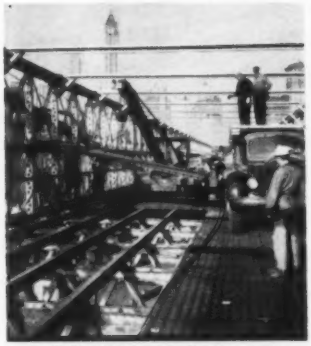
● ***THIS county station wagon is a unit in CD communications.***

● ***ALERTS come to Fire Dept.***



● ***COUNTY salvage and repair car is two-way radio equipped.***

HOW REBUILDER OF BROOKLYN BRIDGE OVERCAME TWO PROBLEMS



● ***CONCRETE filled grating will form new bridge roadway.***

ENGINEERS of the Klevens Corporation, the general contractors handling the $3,500,000 reconstruction project for the historic Brooklyn Bridge, encountered two serious problems which required, for their solution, expert engineering skill. The first of these was the finding of "brittle" spots in the old steel. Though it had been expected that some difficulties would arise because certain unknown features of the bridge were to be exposed in the work of reconstruction, these brittle spots were quite unexpected. They were found when workmen drilled through the old steel to place rivet holes. In these brittle spots, the steel would break out, resulting in holes unsuitable for riveting.

The brittle spots were due to the poor quality of the alloy steel that went into the original construction back in the 1880's. The Brooklyn Bridge was the first one constructed with alloy steel; and the alloy steels of those days did not have the uniformity and quality of present day alloy steels.

To meet this difficulty, J. A. Klevens, president of the Klevens Corp., proposed the use of welding in place of riveted work. After consideration, this proposal was adopted by the engineers of the New York City Public Works Department, the reconstruction plans were changed and welding was used. This not only solved the problem, but afforded even stronger and more rigid construction.

Problems in Balance

A second problem in the reconstruction of the bridge was the matter of balances. It was necessary to maintain an equal distribution of weight throughout the entire bridge in order to prevent possible cracking of the towers and unsafe stresses in the members. The reconstruction called for modernization of the traffic roadways, and included removal of the steel trusses, cross-beams, pavement blocks and train and trolley tracks. In this removal, many

● ***GRATING is being welded prior to concrete filling.***

tons of steel and of blocks were involved, seriously affecting the weight distribution along the span. It was therefore necessary to equalize the balance by working at each end and by removing equal weights on either side of the towers. According to Mr. Klevens: "The new weight of the bridge is about the same. We have removed a wood block pavement 9 ins. deep, and tracking, and have replaced it with a 3-inch pavement of concrete poured into Carnegie 3-inch steel grating. The concrete filled grating is used throughout the new roadway, over the entire length of the bridge. This type of pavement will stand up better under traffic wear and will eliminate the hazards caused by the uneven and often slippery wood blocks and the slippery trolley tracks of the old two-lane roadway. The job we are doing will not only add to the beauty of the bridge, but will make it a modern, practical vehicular traffic structure. The new and wider roadways will more than double previous traffic capacity, increasing it from 3,000 to about 6,000 vehicles per hour. In contrast to the old narrow two-lane wood-block roadway, made even more hazardous by the slippery trolley tracks, the reconstructed road has three wide lanes for fast moving traffic, each with a pavement of smooth concrete poured in steel gratings.

"We were amazed to discover such little corrosion. Less than ten tons of the original steel had to be replaced. Most of the steel was in excellent condition. This is due to the open structure of the steelwork, which enables the rust-producing moisture to evaporate, preventing corrosion. This same open type of structure also made practically every surface of the steel accessible to painters who, during the years have kept the steel covered with suitable layers of protective paint."

Another, but smaller, problem was presented by the granite towers. This granite is probably harder and tougher to-day than when it was originally erected. It is so hard that drillers find it difficult to cut into the stone. Ordinary drills break quickly, and it has been necessary to use special carborundum drills. The granite towers show hardly any effects of weathering after nearly 70 years of service.

● ***NEW 3-lane roadway can handle 6,000 cars per hour.***

Material Requirements for SEWAGE AND WATER INSTALLATIONS

FOLLOWING the article in the November PUBLIC WORKS which presented data on the amount of steel required for sewage treatment plants, such Federal Agencies as the Bureau of Labor Statistics and the Public Health Service began the collection of data on a broader basis and covering a greater variety of installations. These data have just been released.

Based on an analysis of some 200 projects completed in 1948, 1949 and 1950, materials amounted to 40% to 50% and labor a little over 30% of the cost of building water and sewer systems and treatment plants. There are some quite marked variations, however, between the four items analyzed—that is, water treatment plants, water distribution systems, sewage treatment plants and sewerage systems.

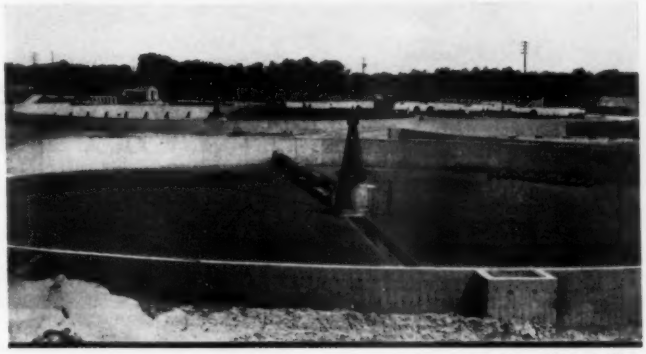
Water Distribution Systems

In the construction of water distribution systems, materials aggregated 49.3%; labor 31.7%; overhead, profit and equipment charges 17.0%; and supplies 1.9%. Metal products were high, as might be expected in water main construction, amounting to 32.8%. This was composed of hydrants and valves 3.6%; pipe and fittings 22.3%; tanks and towers 3.7%; reinforcing steel 0.9%; and other miscellaneous items 2.3%. Machinery and equipment amounted to only 3.7% of the total and was mostly pumping equipment (1.1%) and meters, regulators and gauges (1.2%).

Stone, glass and clay products were 10.5% of the total, with cement asbestos pipe (6.0%), concrete pipe (1.8%) and concrete (1.5%) the principal items. Lumber products required 0.6% of the total; and other materials 1.8%, of which paving materials and mixtures comprised 1.2%.

Sewerage Systems

Labor and equipment charges (also overhead and profit) were highest on this kind of work. Labor amounted to 33.5%, overhead, profit and equipment 27.3%; and materials 37.2%. Sewer lines must be laid for gravity flow and require deeper excavation and more manhours in placing the pipe; and, of course, more supervision cost in proportion to the cost of the material used.



Courtesy Natco

● *SOUTH Side sewage treatment plant at Oklahoma City, Oklahoma.*

Only 10% of the total cost went for metal products, and this was spread over a number of items, with only reinforcing steel (4.0%), metal pipes and fittings (1.5%), and structural steel (1.8%) of any importance. Machinery and equipment totalled only 4.2%, while stone, clay and glass products amounted to 17.2%; lumber products to 2.7%; and other materials 3.2%, of which 2.8% was for paving materials and mixtures. Supplies totalled 2.0% of the job cost.

Sewage Treatment

The material requirements for sewage treatment construction vary considerably from those for water treatment. The cost for materials was 53.5% of the total; and of this 16.8% was for metal products and 15.9% for machinery and equipment. The major items under metal products were: Hydrants and valves 1.1%; pipe and fittings 5.7%; reinforcing steel 5.0% and structural steel 1.3%. The major items under the 15.9% for equipment and machinery were: Electrical equipment, wiring and fixtures 3.1%; pumps and pumping equipment 2.3%; sewage treatment equipment 8.4%; and meters, regulators and gauges 0.8%.

Of the 16.6% expended for stone, clay and glass products, 1.2% was for brick, 1.0% for cement; 9.6% for premixed concrete; and 2.4% for aggregate. Lumber products cost 2.5%. Supplies aggregated 1.2%; labor 28.0% and overhead, profit and equipment charges 17.3%.

Water Treatment Plants

Materials accounted for just about half of the total expenditures for new water treatment plants—an

(*Continued on page 57*)

TABLE I—Material, Equipment and Labor for Water and Sewerage Construction

	Water Treatment	*Water Distribution*	*Sewage Treatment*	*Sewerage Systems*
Labor	30.1%	31.7%	28.0%	33.5%
Metal Products	19.0%	32.8%	16.5%	10.0%
Machinery & Equipment	15.1%	3.7%	15.9%	4.2%
Stone, Clay, Glass	13.4%	10.5%	16.6%	17.2%
Lumber	1.3%	0.6%	2.5%	2.7%
Other Materials	1.6%	1.8%	2.1%	3.2%
Supplies	1.9%	1.9%	1.2%	2.0%
Overhead, Profit, Equip.	17.6%	17.0%	17.3%	27.3%

PROBLEMS IN RAIN MAKING

T. H. EVANS
Dean of Engineering,
Colorado Agric. & Mech. College

IN the far western states during the past two years there has developed almost a tidal wave of large scale operations to force nature either to give up or to withhold moisture in the atmosphere to suit the will of man. This work comes under the general heading of artificial nucleation, a scientific development that is only an infant but which gives promise of unbelievable results. It is claimed by one operator in the field that it is possible in many arid regions of the country to double the average annual precipitation or runoff. This means doubling either the average annual rainfall, or snowfall, or a combination of these, depending on the region. It is further claimed that hail can be prevented, and that undesirable rain can be prevented at will. It is even believed by some that fog can be dissipated where desired. These are merely some of the claims. Perhaps they will all be substantiated. Most of us who live in the arid and semi-arid west hope they can be.

It is easy to imagine the terrific impact of such an achievement on agricultural practices, engineering, law, economic level, transportation, domestic water supplies, hydroelectric power, and almost every human activity. If the claims prove correct this will be the biggest thing since the atomic bomb. The impact, of course, will not be limited to the drier sections of the country but will be felt nationally. The large scale experiments that are going on in the west were tried in the New York City watersheds to improve the critical situation that developed there in 1950.

What Could Happen

The impact would radically alter certain agricultural practices because it would not be necessary to hope for rain in dry farming—it would be there about when wanted. Susceptible areas that now rely entirely on a little rain and elaborate irrigation systems could forget their worries about water shortages in the system, or about priorities under appropriation law. In fact priorities might even become unnecessary if there were always assurance of an abundant water supply. Towns that are now limited because of inadequate water supply might continue to expand. Regions that are short on industry because of inadequate water could begin to attract industries. Areas that have had their economic level held down because of all too frequent crop failures could begin to raise that level. Grazing lands would be lush with rich grasses. The threat of dust bowls would disappear. Streams would have new and higher averages that would be free of the extreme variations that exist now. Hydroelectric plants could operate on a larger firm power load. If fog could be dissipated at will, the transportation systems—particularly ship and air—could maintain better and safer schedules.

This all sounds too good to be true, and that may be just the case. So far there is no conclusive proof, on a sound scientific basis, that all this can be done. In the first place there has not been sufficient time for adequate proof and, secondly, even outstanding meteorologists, who are most closely allied to this scientific field, are in disagreement as to its possibilities. We, in the west, where additional water is needed badly in most areas, want the experimenters and operators to have every reasonable opportunity to prove their claims. We feel that these large operations on a county- or basin-wide, scale must be continued for enough years to acquire reliable scientific data for evaluation.

How Rain Making Started

All of this really got started just a few years ago. Although many laboratory research men, here and abroad, had delved into the science of meteorology and cloud physics for decades, it was probably not until Schaeffer's experiments at General Electric in 1946 that the real possibilities of causing artificial precipitation from certain types of clouds was fully realized. Dr. Irving Langmuer made some large scale experiments in New Mexico in 1949 that received considerable publicity and seemed to start a chain reaction of other experimentation. There are now many commercial concerns operating in this field under various kinds of contracts with farmers, ranchers, municipalities, etc. At present practically anyone can try to milk clouds or knock off thunderheads but the fly-by-night operator

with no experience, unsuitable equipment, and poorly trained personnel will probably only last a short time.

The principal method used today is that which involves spraying vaporized silver iodide into the atmosphere from the ground in such a way as to disperse it by winds to the so-called "target" area. By the time the particles have travelled some distance downwind from the generator they have dispersed into a very large volume of air—both vertically and horizontally. The optimum conditions within the area must be such that precipitation is incipient and lacks only the necessary nuclei to trigger it off. It is possible also to "over-seed" and dissipate a potential rain, or even the entire cloud. Nuclei are quite often there naturally. If not, however, and all other required conditions exist, then the artificial nuclei will start things going. Another advantage of the artificial nuclei is that even though some natural rain would fall, the amount can be increased because such nuclei are effective at much lower altitudes in a cloud than are the natural nuclei. This article will not attempt to explain the theories involved in this complicated set of phenomena. The explanation has been given in several outstanding scientific papers by authorities in the field such as Langmuir, Schaeffer, Vonnegut, Krick, etc. A very good popular explanation is that by Roscoe Fleming in *Public Power* for October 1950.

Another still common but apparently less efficient method, that was actually in use before silver iodide, involves using dry ice dispersed from an airplane. It has the big disadvantage of requiring expensive airborne equipment, and gives dispersal on vertical surfaces rather than over a large volume. It further requires operation under the most unfavorable flying conditions. Although silver iodide can be dispersed from a plane, the usual practice is to employ ground generators.

The need for additional, reliable water supplies in most of the far west is quite obvious to those who live in its vast arid and semi-arid sections. The need is probably also evident to those who live in the more humid regions of our country but have travelled through the west, have seen pictures of it, or have read of the antagonisms that develop between some western states over a relatively small quantity of water. This crying need is the reason there

● ***SNOWFIELD** in the high Rockies. Photographs like this are used to estimate snow cover and subsequent spring runoff flow.*

● ***MAIN** stream diversion dam on a western river. A stream like this constitutes a life-giving water supply in an arid region.*

● ***WATER** source at the Continental Divide. This photograph was taken in the summer. Winter is something else again.*

have been so many large scale operations carried on in California, eastern Oregon, Arizona, New Mexico, and Colorado during the past two years. It is understood an operation on the vast King Ranch in Texas is contemplated for this year. It appears that the operations will snowball into such a multitude that the state of Colorado as an example, may be almost completely covered by contracts from the Continental Divide to the Kansas and Nebraska line on the east. About the eastern one-third of Colorado is practically all dry land farming. It was part of the dust bowl of the early thirties. Large parts of the remainder up to the eastern edge of the Rockies are irrigated. There are even extensive

• ***GRAND Valley canal in Colorado. To the right is Colorado River—every drop needed.***

• ***INCREASES in snow pack are attempted in high water supply areas like this one.***

mesas within the Rockies that are largely irrigated. Colorado is second only to California in the acreage irrigated in the United States.

Types of Rain-Making Contracts

There seem to be several types of contracts available to those who hire the operators. One is a flat fee for a service covering a definite time interval in months or perhaps a year. In this case the contractor does not necessarily guarantee any specific results. Another type might be called a minimum-maximum contract. A minimum fee is paid no matter what happens, but if a stated increase (perhaps doubling an annual average) is proven then the maximum is due. A third type could be called a double-or-nothing contract, since that is just about the way payments would be made. If the goal is to increase an annual average, a certain sum would be due if accomplished. If not, then nothing is due. Of course, if the operator came through on this latter type his total fee would be larger than in the other two types. Any kind of a contract might be negotiated but most possibilities would be some of the examples given, or a combination of them. As a numerical example of cost it was proposed in one case that for doubling the average annual runoff from an increased snow pack the third type of contract would cost $100,000 or nothing. The quantity of extra water under consideration was about 350,000 acre feet. In most regions this is very cheap water *provided the farmers wouldn't get it naturally.*

The Need for Water

It is easy to see why the desire to try these methods of getting additional moisture is spreading and has reached pandemic proportions. Many regions of our west suffer almost continual drought for many years in succession. Other areas have "mined" their water tables to supplement surface supplies to such extents that critical situations are developing. In other areas there just isn't enough surface water to irrigate properly all irrigable land or to supply cities and towns with enough domestic water. The new artificial precipitation science looks like manna from heaven if all the advertising, as well as statements from some outstanding scientists, prove correct.

Because there is disagreement, however, between top-notch scientists regarding the possibilities and long range worth of weather control through artificial nucleation, it is evident that proper scientific evaluation must be made over a reasonable period of years. How much of the increases claimed in precipitation is natural and how much is purely artificial? It is relatively easy to measure total precipitation and runoff but we don't know how much is natural and how much artificial in these operations. It is a satisfactory yardstick to measure these components of the total that we need. No one seems to have devised that yardstick yet that is acceptable to all scientists. Methods are available, which over a span of perhaps 3 to 5 years, *may* prove something, although longer periods would provide better results. In the case of rainfall, however, the accuracy of results would depend for one thing on the adequacy of coverage in the target and adjacent areas by gages of long and reliable past records. Really good coverage does not exist in most regions that might be affected. At any rate some evaluation is better than none, and unless the present large scale operations are properly evaluated by qualified neutral agencies, then a marvelous opportunity will be lost and we may never have an unbiased answer. People are skeptical for the most part of evaluations carried out by operators who are in the business to make a profit, no matter how honest and sincere they may be.

Needed Legislation

Because of the need for evaluation, so the public will be properly informed in the near future, there is need for legislation. As a bare minimum the legislation should require registering or licensing operators in order to keep track of them and their areas of operation. It should require also, a central agency to receive regular reports from operators as to when and where they operate in order to have proper data on which to evaluate the results. If there isn't such an

(*Continued on page* 76)

SANITARY LANDFILL

Handles

9 ½ Million Yards Yearly

HENRY LIEBMAN

Director of Operations,

Dept. of Sanitation, New York City

ONE of the largest sanitary landfills in the world is being conducted by the New York City Department of Sanitation at Fresh Kills, Staten Island. New York's refuse amounts to about 5,000,000 tons, or 27,000,000 cubic yards annually. Of this amount about 35%, that is 1,800,000 tons or about 9,500,000 cubic yards in volume, is brought to this site for final disposition. The contributing population, totaling about 3,500,000, reside in Manhattan. northwest Brooklyn and Staten Island. In the future, refuse from the northern part of Queens will also be sent to Fresh Kills.

The Fresh Kills site is located on the western part of Staten Island along Arthur Kill and the Fresh Kills. "Kill" is an old Dutch term for channel or creek. The site comprises about 2,600 acres of marsh land and is one of the few remaining areas of this type still available for landfill purposes in the city. Its location and subsurface conditions presented, and are presenting, many difficult engineering problems both in the preparation of the site and in the daily operations. Difficult foundation conditions, mud waves due to superimposed loads, extreme tides, and drainage requirements are only a few of the problems associated with this extensive landfilling project.

New York's Waste Disposal Program

New York City has embarked on an extensive program of incineration which, when completed, will destroy all combustibles, but the disposition of ashes, incinerator residue and non-combustibles will always present a problem. These items will amount to about 3,000,000 tons per year. The only practical way of disposing of this material is by the landfill method, since the U. S. Supreme Court enjoined the City of New York from dumping at sea. Until the incineration program is completed, which will take another eight or nine years, the refuse being dumped at Fresh Kills will contain some unburned garbage. The amount of unburned garbage will be reduced somewhat when the Gansevoort Incinerator, now being constructed, is completed. The life of the Fresh Kills Plant will be affected by the progress of incineration and has been estimated to be about eighteen years.

In the past disposal operations of this nature were carried out in a fashion that made "garbage dumps" an odorous, smoking, insect and rat ridden nuisance. Nearby residents complained long and loud, obtained injunctions and stopped operations. To avoid a repetition of these nuisances, special precautions are being taken and the operation now bears the more euphonious title of "Sanitary Landfill". Before operations at Fresh Kills commenced, civic associations organized against it and a Grand Jury presentment declared "Fresh Kills will bring discomfort, unhappiness and danger to health to a great proportion of the population of this county". In the three years of operations we have received practically no complaints but, on the other hand, much praise from civic officials, civic associations and the local newspapers. The precautions and modus operandi consist mainly of complying with the steps outlined in the Sanitary Code of the City of New York with the addition of new techniques that have been developed by the operators.

Operating Regulations

The Sanitary Code Regulations governing landfills are as follows:

1. The disposal of wastes by the landfill method shall be planned as

an engineering project. General supervision shall be provided by a sanitary engineer for the operation and maintenance of landfills.

2. The face of the working fill shall be kept as narrow as is consistent with proper operation of trucks and equipment in order that the area of waste material exposed during the operating day be minimal.

● ***COVERED scow being made ready for tow to landfill.***

3. The exposed surface shall be covered with earth as promptly as is consistent with proper operation and at the close of each day's operation both the surface and the face of the fill shall be completely covered, the object being to make a closed cell of each day's deposit.

4. Sufficient standby equipment shall be provided to prevent delay in covering, due to breakdowns or peak loads.

5. Waste building material, concrete or other bulky waste material which may furnish rat harborage shall not be used for the final surface or side slopes, but shall be promptly incorporated within the fill.

6. The final covering for surface and side slopes shall be maintained at a depth of approximately twenty-four inches.

7. In case the finished fill has a boundary side slope, the toe of the slope shall terminate in a sand and gravel-filled ditch so as to prevent raveling of the toe with exposure of some of the waste material, the burrowing of rodents; and, finally, to obviate puddles by permitting seepage from the fill to be absorbed into the ground.

8. Spraying of the exposed waste material and adjacent surfaces shall be used when necessary to allay dust.

9. The layer of refuse shall not exceed an average depth of fifteen feet after initial compacting. Where deeper fills are necessary the filling shall be carried on in stages.

10. Control over the blowing of papers shall be adequately maintained by the use of movable snow fencing.

11. While the maintenance of proper earth covering as hereinbefore required will to a large extent prevent fires, water under pressure shall be available for fire fighting purposes. If scavengers are tolerated they shall be adequately supervised.

12. All collections of surface water resulting from these landfill operations shall be drained, filled or treated with effective chemicals so as to prevent mosquito production or allay disagreeable odors.

13. Where necessary, effective steps shall be taken to prevent flotage of waste material into open water.

14. Inspection for and control of rodents shall be maintained until the fills are stabilized.

15. After the active period of filling operation is completed a maintenance program shall be continued

● ***TRAINS of Athey wagons are being loaded at Plant 1.***

until the fill has become stabilized so as to insure prompt repair of cracks and depressions, and erosion of the surface and side slopes.

These regulations have been strictly adhered to, resulting in a nuisance-free operation.

The Fresh Kills Landfill being located on Staten Island, refuse must be transported to it by water, except for the small amount originating on Staten Island which is brought to it by truck. Barges are loaded at ten Marine Loading Stations, five of which are of the enclosed type and five open. The enclosed types reduce the dust nuisance to the adjacent property and it is intended to convert or abandon the open stations in the future. Loading is done directly from trucks at eight locations; by a crane at one where only residue is loaded; and by a retractable conveyor at another. Incinerator residue is loaded directly by dragline at the Greenpoint and Hamilton Avenue Stations from the Greenpoint and Hamilton Avenue Incinerators. The loading operations continue around the clock and in most cases seven days a week.

Barges and Tugboats

Each barge has a capacity of 2,000 yards level with the top of the hopper and about 2,500 cubic yards heaped load. The loads vary from 550 to 650 tons depending upon the unit weight of the materials. Each barge has living quarters aboard and carries a Barge Captain while in transit. They measure about 150 ft. in length, 37 ft. in width and 12 ft. 9 in. in depth. Refuse hoppers, which extend 5 ft. above the deck, have a depth of 14 ft. 6 in. Transverse and longitudinal bulkheads divide the double bottom into six watertight compartments. The barge fleet numbers forty-two, of which four, on an average, are out of service at all times for repairs.

Barge tows consist of two to four barges depending upon the weather, tide and other factors. These are towed by modern tugboats equipped with 700 hp G.M. diesels operating at 750 rpm. The tug boats have steel hulls 85 ft. in length, are 24 ft. beam and have a normal draft of 9 ft. 4 in. They are equipped with pilot house automatic engine control. Two 30 kw generators provide power for the starting batteries, auxiliaries and lighting. The Department has a fleet of three tugboats in addition to three small boats for shifting purposes at Fresh Kills. The tugs provide living and mess accommodations for two full crews on each boat. The tugs aver-

● ***ATHEY wagons are being dumped over face of fill.***

age about 5,000 towing miles and 100 shifting hours each month. The distance of tow varies in length from 13 miles to 27 miles. A complete commissary and storeroom, repair facilities and central dispatching

headquarters are maintained at Pier #70, East River.

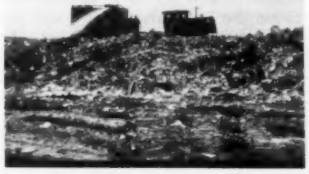
Loaded barges are towed to Fresh Kills and moored alongside the unloaders. There are two of these fixed plants designated as Fresh Kills Plant #1 and Plant #2. Their construction was complicated by the subsurface conditions involving the driving of piles, construction of bulkheads, dredging of the channel and construction of mooring racks. Unloading equipment at each plant consists of a complete steam operated Lambert Digger equipped with a 10-yard Wellman clamshell bucket. Two oil-fired Cleaver-Brooks units at Plant #1 and two Preferred Utilities units at Plant #2, all high-pressure steam generators, furnish the 125-pound steam required for the operation of the digger and its auxiliaries. Loaded barges are maneuvered under the digger by a gypsy or pulling engine and the refuse removed in layers to maintain the trim of the scow. About twelve to fourteen yards are removed at each bite of the bucket. Although a portion of material is left in the scows to protect the bottom, occasionally considerable damage is done by these heavy units, which weigh about 12 tons each. In addition to the two fixed installations there are two marine diggers equipped with 5-yard buckets mounted on barges. These are used for emergency standby service and for thorough cleaning of scows that are to be sent to the shipyards for repairs.

The buckets discharge directly into Athey wagon trains. These consist of two or three Athey wagons hauled by a D8 Caterpillar tractor. In bad weather, a dense fog or a

● ***DUMPED material is being bulldozed to working face.***

good deal of rain or snow, it has been necessary in the past to reduce the train to one wagon per tractor. The average speed is two miles per hour loaded and three miles per hour empty. The wagons which are side dumpers, hydraulically operated, are mounted on crawler tracks. They carry about forty yards of refuse each. Two new units of fifty-three yard capacity have been purchased recently. In an endeavor to secure a high speed unit because of the lengthening hauls, a test of a 55-yard rubber tired Tournarocker has been made.

The dumping point at Plant #1 is, at the present, about 3,000 ft. from the unloader. Each round trip takes about forty minutes. Material is discharged by the wagons alongside the working face and then pushed down the bank by bulldozers. The continual travel of the heavy trains and bulldozers serves to compact the fill. Material is deposited in successive lifts about 8 ft. in thickness. The completed fill measures from 15 to 35 ft. in depth. It has been observed that the refuse deposited compacts to approximately one-third of the large volume, but some of this observed compac-



● ***SPRAYING working face with disinfectant before cover.***

tion may be due to settlement of the marshy foundation.

Before covering, the fill is sprayed with a disinfectant consisting of a solution of one part orthodichloride-benzine, nine parts of an emulsifier and ninety parts of water. A tank wagon has been equipped with sprayers for this purpose. At the end of each day's operation a layer of covering consisting of clean sand and clay is placed upon the fill. The tightly compressed fill does not afford rat harborages and the cover prevents rats from burrowing in and inhibits the development of insect nuisances. It is intended eventually to cover the completed fill with a two-foot layer of clean earth. All operations are carefully planned, topographical layouts and drawings showing the grades, drains and sequence of operations are prepared in advance and adhered to during operations.

Two draglines, one Bucyrus Erie and one L-80 Lorain dig up cover from areas on the site and load it into Athey wagons for transportation to the working place. Four LeTourneau Carryalls are also used for this purpose. There is enough cover available on this site. The surface of the completed fill is given a 2% slope to provide drainage to prevent ponding and mosquito breeding. Necessary ditches are dug by the

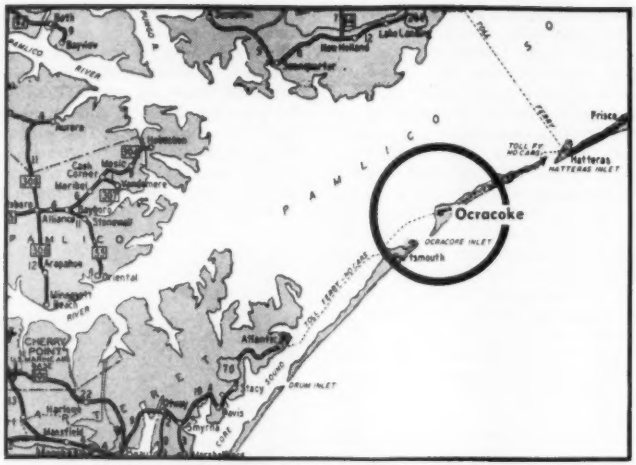
● ***COVERING the fill with selected material with dozers.***

draglines, and culverts and drains installed.

The total investment in land, engineering, construction and equipment for Plant #1 was $3,000,000 and for Plant #2 about $2,000,000, a total of $5,000,000.

The operation is a vast one requiring a large labor force. The present method calls for two-shift operation at both plants. There are 270 men employed at the present time and the payroll amounts to approximately $1,200,000 annually. Direct operating costs at Fresh Kills, not including capital charges, amount to approximately $1 per ton. The Marine Loading Stations and towing costs amount to approximately $0.43 making an average cost of this entire operation of $1.43 per ton.

Commissioner Andrew W. Mulrain is in charge of the Department of Sanitation of the City of New York. The author is the Director of Operations. All the operations described in this paper are carried on in the Bureau of Waste Disposal headed by Henry F. Cunningham, Senior Mechanical Engineer, and his assistant William T. Stevenson. Charles Bayers, Civil Engineer, is in charge of the marine activities and Maurice Feldman, Sanitary Engineer, has general engineering supervision over the landfill activities. Operations at Fresh Kills Plant #1 are under Superintendent Joseph Merkle, and at Fresh Kills Plant #2 are under Acting Superintendent Thomas J. McPartland.



● *MAP shows isolated position of Ocracoke Island.*

OCRACOKE'S

J. L. MORRISON
University of North Carolina

THE wild and desolate Outer Banks of North Carolina, known to mariners as the "Graveyard of the Atlantic," are on the way to being tamed by the road-builders. Latest of the Banks to get roads is Ocracoke Island, which in 1950 acquired a little more than two miles of pavement. The story really begins with the Navy's anti-submarine campaign during World War II and involves, more directly, North Carolina's Physical Testing and Concrete Laboratory which devised a mix by means of which Ocracoke's beach sand could be utilized in road building.

When, back in 1942, the Navy PT-boat base at Ocracoke was fighting an uphill struggle to protect from German submarines the oil-laden tankers plying the East Coast, the director of the Concrete Laboratory in Raleigh, J. E. Thompson, got a hurry call to lend a hand. It was an emergency call for a mortar mix which would utilize beach sand for a few vitally needed roads. Use of beach sand was necessary because of the impossibility of shipping in aggregates or heavy equipment. In specifying a mix with a compressive strength of 2500 pounds per square inch in 28 days, the Navy also made it clear that it couldn't wait as long as 28 days for the finished product, but that the Laboratory would please turn it out in seven days.

The mix must have worked because the Laboratory heard not another word from the Navy. Mr. Thompson assumed the road work was another hush-hush project and knew enough not to ask too many questions in wartime.

In making up a series of test cylinders containing varying quantities of cement, Mr. Thompson assumed the seven-day strength to be 75 per cent of the 28-day strength. The final mix proportions for the mortar turned out to be 2.1 barrels of cement per cubic yard of mortar, and the quantity of water 7.8 gallons. Fortunately for the war effort, the Ocracoke beach sand contains a heavy admixture of shells which have some of the properties of coarse aggregates.

Why the Mortar Mix?

This particular mortar mix was made necessary, too, by reason of the fact that heavy trucks can not operate at Ocracoke, even assuming they can be successfully landed. Vehicles of any considerable weight will bog down quickly, and even light vehicles must have their tires deflated before proceeding. Moreover, the island's docking facilities are altogether inadequate for heavy equipment. Adding to the island's isolation is the fact that its channel is dangerously shallow, and even the ferry which plies between the island and the small mainland town of Atlantic often touches bottom several times each trip. All these factors added to the impracticability of using heavy equipment and going ahead with cement stabilization.

When the State Highway Commission engineers made the trip to Ocracoke for the surveys which resulted in the road-building of 1950, they found that the Navy had made good use of the emergency mortar mix. The paving at the old Navy base was found to have held up quite satisfactorily, and at once the highway engineers knew they had an answer to the problem of building a vehicular road at Ocracoke—the mix that had been devised in the Concrete Laboratory almost a decade before.

● *ROAD-building equipment arrives via Marine Corps barge.*

BEACH SAND ROADS

Road building time and shrimping and fishing time coincide too well for Ocracoke's fishermen to desert their nets, but the highway engineers recruited a labor force that stayed on the job with commendable persistence. Many of the crew were older high school boys, and the result was that only about 10 men had to be brought over from the mainland and housed on the island. Temporary living quarters for the road-building crew were set up at the old Navy anti-submarine base of World War II days.

No Hurry At Ocracoke

Because there is no through traffic at Ocracoke the highway commission engineers decided on a 10-foot road. The total car population of the island is not much above 40, and it is taken for granted that nobody at Ocracoke has any need to be in a hurry.

The road's foundation is no great problem either, since the sand—because it is confined—makes an excellent foundation. Of more concern, however, is the constant danger of the road being undercut by water—regardless of the type of foundation—in one of the island's great storms. Hurricanes, though infrequent, are known to hit Ocracoke with tremendous force, and on such occasions there is no doubt that considerable road repair work will be in order.

Getting materials to Ocracoke for the road building job provided many an anxious moment. For one thing some 18,000 bags of Lone Star cement had to be shipped all the way from Norfolk by the island's two freight boats. The cement shortage was so severe at the time that the cement was loaded on the freight boats uncooled from the kilns. This hot cement, in turn, opened some of the seams of the boats, which meant that it took a pretty piece of navigating to land their cargoes safely at Ocracoke. Road-building equipment had to be ferried across the Pamlico Sound by means of an all-steel pontoon-type barge borrowed from the Marine Corps installation at Camp Lejeune.

Equipment ferried over from the mainland consisted of the following major items: one TD-18 tractor-bulldozer; one TD-14 tractor; one 9 cu. yd. LaChoate pan; one FWD truck; one #22 Caterpillar pull grader; one Corbitt truck; two 2-bag Gilson mixers; one 3″ centrifugal Wisconsin pump; and one 3″ centrifugal Jaeger pump.

The necessary grading for the 2.05 miles of 6-inch uniform concrete pavement was done with the use of the two tractors, pan and pull grader. Prior to setting a job mix for the pavement, a 5-inch cube was cut from a specimen of the fine aggregate concrete which was poured at the Navy Base in the summer of 1942. Compression tests on this cube showed a strength of 2944 psi. Presumably, the aggregate used in this specimen came from local deposits along the beach and adjacent to Ocracoke Village. Highway Commission forces located other deposits of this material and used it in the mortar mix.

A job mix was set in the following proportions: Cement—94 pounds; Ocracoke Island sand—280 pounds; Water—7.8 gallons per bag of cement. The water content was kept to the minimum that would permit a workable mix. A three-bag batch, mixed during the concreting operations, could be handled in a two-bag mixer without overcharging it, because of the absence of coarse aggregate in the batch.

The concrete was hand-finished by a steel screed and bow belt, and cured under wet burlap for 72 hours. During the concreting operations only one mixer was used at the time, the other being retained as a spare in case of breakdown. An average day's run netted from 375 to 425 linear feet of finished pavement.

The sand and cement were stockpiled along the shoulders and the mixer charged therefrom, the water being supplied to the mixer and for curing purposes by way of pipe line from four shallow wells. Pipe was 1¼-inch and well points were set about 6 ft. deep and connected to a 3-inch pump. These wells could be set very easily and were moved frequently as the work progressed.

For field testing the strength of the pavement, beam specimens 6″ x 6″ x 30″ were made frequently and properly cured. Tests on these showed a flexural strength in pounds per square inch of 550 to 650 pounds at an average 10-day age.

This pavement contained no reinforcing steel or expansion joints, and surprisingly few cracks had developed at the completion of the project. These few were poured with crack filler. Shoulders were built and seeded to retard wind erosion and to improve the appearance.

A novel touch in the development of Ocracoke's new roads is the behavior of the island's famous wild ponies. These shy little beasts are said to have roamed the island for more than 200 years, the supposed descendants of Barbary ponies brought by Sir Walter Raleigh's colonists. Coarse salt grass has al-

(*Continued on page 75*)

● ***SMALL concrete mixer at work. Youpon trees in background.***

HIGH RATE ANAEROBIC DIGESTION

THE anaerobic digestion of meat packing wastes has been investigated by W. J. Fullen, chemist, and L. W. Murphy, of the George A. Hormel Co., Austin, Minn., and experimental and test work has been carried on over the past three years. The plant wastes, from which sanitary sewage and condensing or cooling water have been eliminated, have a 5-day BOD of 1200 to 1400 ppm, a pH of 6.6 to 7.2 and a temperature of 85° to 105°F.

The initial work, on a laboratory basis, utilized oil drums for plant units. Later, based on the result of the laboratory scale work, a larger plant was built. The following conclusions were obtained from the laboratory scale investigations:

(1) The waste can be digested in either the mesophilic or the thermophilic range. The latter gave more rapid digestion, but digestion was more difficult to control and there was considerable colloidal material in the effluent. A temperature of 90 to 95 degrees appeared best.

(2) There appeared to be little, if any, difference in inoculums from different sources. Two digesters, operated simultaneously with sludges obtained from two different plants, gave essentially the same results.

(3) It was possible to obtain 90% to 95% reduction of BOD in one to two days detention time. Stronger wastes gave better results. Weaker wastes were economically unfavorable because of less gas production.

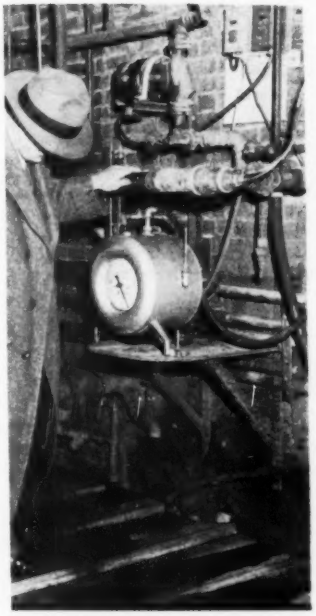
(4) It was necessary to train or develop a suitable culture. This required from four to six months and was accomplished by feeding the organisms at a rate commensurate with their ability to utilize food. Gas production, volatile acids and pH were the criteria. A fall in gas production and pH, with increasing volatile acid content, indicated too rapid feed.

(5) It was found necessary to return escaped culture back to the digester to maintain a favorable concentration of the culture organisms.

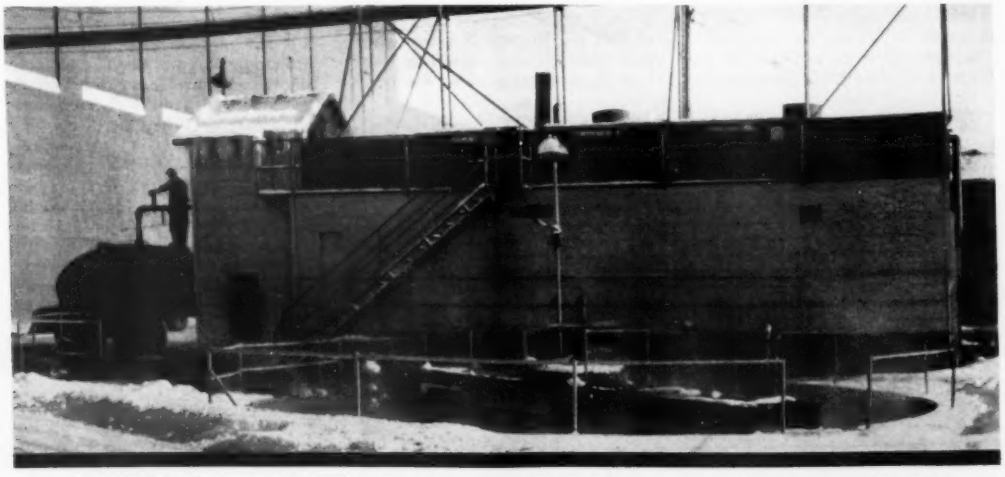
(6) Pre-inoculation of the incoming raw waste with digester overflow appeared to speed the reaction.

(7) More work was done per unit of digester volume on strong than on weak waste. Removal of BOD per cubic foot of digester volume varied from 0.24 lb. for strong wastes to 0.02 lb. for weak wastes.

(8) Results indicated a 90% to



● *ONE of the authors, Mr. Murphy, checks operation.*



● *GENERAL view of the plant during winter operation. Sludge tank truck is shown at the left.*

OF MEAT PACKING WASTES

95% reduction in BOD could be obtained with a detention time of 24 hours and that 5-day BOD removal of 0.1 lb. per day per cubic foot of digester volume could be anticipated.

The Pilot Plant

The pilot plant built as a result of the laboratory experiments consisted of the following units: A holding tank of 460 cu. ft. capacity; a digester of 880 cu. ft. capacity; a settling tank the same size as the holding tank; and a heat exchanger having 4.7 sq. ft. of heating surface. The digester was completely covered and sealed; the other units were uncovered, but it is believed that it would be better if all were covered. Four pumps were used: To pump raw waste to the holding tank; to provide constant recirculation in the digester; to return sludge from the settling tank to the holding tank; and to deliver feed to the digester. Gas was collected and measured; meters were placed on raw feed and sludge return lines. The holding tank, digester, pumps and lines were insulated.

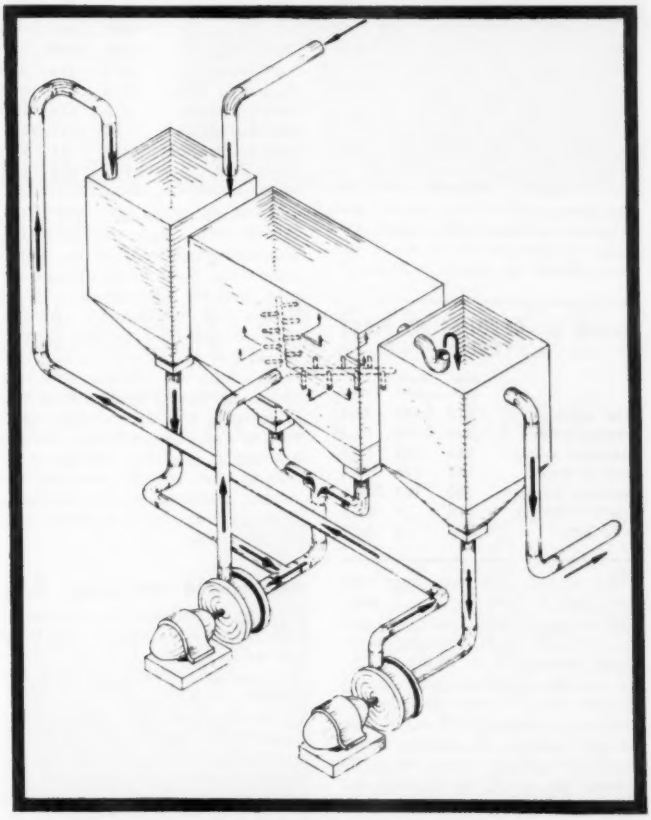
Starting the Plant

The pilot plant was started with 3,000 gallons of an inoculum from the primary digester of the city of Austin sewage treatment plant. The chemical analysis of the inoculum is shown in Table 1.

TABLE I—INOCULUM ANALYSIS

Total solids	28,694 ppm
Volatile solids	16,420 "
Suspended solids	25,104 "
Total nitrogen	2,019 "
Ammonia nitrogen	1,033 "
Organic nitrogen	986 "
Volatile acids	69 "
NaCl	1,380 "
5-day BOD	2,385 "

The rate of raw feed during the starting period was 100 cubic feet per day. An additional 1,500 gallons of inoculum was added 22 days after the digester was started. The 100-cu. ft. feeding of raw waste was maintained as long as gas production was steady. Whenever gas production rose, the rate of feeding was increased. Several times during the starting period it was necessary to discontinue feeding for a few days. It required 131 days before the digester could be fed at the rate of one day of detention time, that is 880 cu. ft. per day. Digestion temperature was maintained at 90 to 92 degrees.



● ***SKETCH of the high rate anaerobic treatment plant, showing holding tank at left; digester, in center; and settling tank, with recirculating piping and pump layout.***

In operation, raw unsettled waste was pumped to the holding tank over a 12-hour period during the day time. Pumping the raw waste to the feed tank over a 24-hour period and at a rate proportional to the flow gave the same results. Recirculation from the settling tank

to the holding tank and thence to the digester was practiced over week-ends and holidays. Otherwise, settled sludge and raw waste from the holding tank was pumped intermittently at such rate that the entire content would be delivered to the digester in 24 hours.

The digester was equipped with a constant level overflow and the discharge from the feed pump caused an overflow to the settling tank.

Test Results

The tests reported extended from Oct. 17, 1950, to Feb. 1, 1951, and were divided into three sections. In the first test, from Oct. 17 to Dec. 1, 1950, 36 days, the total amount of raw feed was 31,970 cu. ft., the average detention time 0.89 day, 5-day BOD removed per day per cubic foot of digester capacity 0.088 lb., and gas produced 10.5 cu. ft. per pound of volatile solids added. Average composition of raw waste and plant effluent is shown in Table II.

TABLE II—RESULTS OF FIRST TEST

	Raw ppm	Final ppm	% Change
Total solids	5,622	4,402	21.6
Volatile solids	1,363	390	71.5
Suspended solids	848	223	73.6
Total nitrogen	145	126	13.4
Ammonia nitrogen	30	105	264
Organic nitrogen	115	22	81.3
5-day BOD	1,461	76	94.8

The second test was continued from Dec. 1, 1950, to Jan. 2, 1951, with 25 days of feed and a total raw feed of 21,310 cu. ft. The sludge returned amounted to 13,431 cu. ft., the average detention time in the digester was 1.03 days and the gas produced totalled 21,179 cu. ft. The gas per pound of volatile solids amounted to 9.5 cu. ft. and the BOD removal per cu. ft. of digester capacity per day was 0.113 pound. Other essential data are shown in Table III.

TABLE III—RESULTS OF SECOND TEST

	Raw ppm	Final ppm	% Change
Total solids	5,630	4,329	23.1
Volatile solids	1,665	354	78.7
Suspended solids	807	139	83
Total nitrogen	170	137	19.8
Ammonia nitrogen	25	119	368
Organic nitrogen	146	18	87.7
5-day BOD	1,948	82	95.8

The third test from Jan. 2 to Feb. 1, with 25 days of feed, used a total raw feed of 21,890 cu. ft. Sludge returned amounted to 10,670 cu. ft. Detention time averaged 1.01 days. Gas produced amounted to 18,898 cu. ft. or 6.7 cu. ft. per pound of volatile matter added. The BOD removed per day per cu. ft. of digester capacity was 0.115 lb. Other data are shown in Table IV.

TABLE IV—RESULTS OF THIRD TEST

	Raw ppm	Final ppm	% Change
Total solids	5,480	4,208	23.2
Volatile solids	2,077	384	81.5
Suspended solids	816	170	82.8
Total nitrogen	170	135	19.1
Ammonia nitrogen	25	114	365
Organic nitrogen	145	21	84.7
5-day BOD	1,959	108	94.5

No recirculation ratio was determined in the first test as it was planned to return all of the settleable solids back to the digester. It soon became apparent that if the sludge had too long a retention time in the final settling tank it would rise to the surface and discharge with the effluent. One way of decreasing the settling time was to increase the recirculation ratio. This was all right in theory but impractical in operation because it increased the velocity through the system resulting in the discharge of sludge that should normally stay in the digester.

Recirculation and Sludge Data

In the second test, the recirculation ratio was 0.63 and in the third test 0.49.

It was noted that the solids in the overflow of the digester were heavily charged with gas. These solids would settle rapidly for 15 or 20 minutes and then the gas in the settled sludge would appear to explode the mass and sedimentation would have to start all over again. Part of the raised sludge would remain at the surface or, at times, the entire body of settled sludge would rise. A mechanical stirrer, operated slowly, seemed to overcome this difficulty. The stirring was done intermittently and at a motor shaft speed of 5.4 rpm, representing a peripheral speed of 3.34 fpm. This treatment appeared to be satisfactory in a tank with a detention period of 3 hours. Degassing by vacuum was also tried and seemed successful.

The sludge was jet black in color, normally with a tarry odor but, when charged with gas, with a slight odor of hydrogen sulfide. The maximum concentrating ability appeared to be about 4% total solids.

Other Factors

The final effluent in all three tests was not offensive in odor; it was clear or slightly colloidal after sedimentation.. No tests were made to determine the action of the anaerobic effluent when subjected to oxidation on a filter, but no difficulty with this is anticipated. A 20-day BOD curve shows no lag phase in the transition from anaerobic to aerobic conditions. A sample of the effluent when mixed with an equal amount of final filter effluent from the Austin plant gave results proportional to the respective BODs of the two samples in the 5-day incubation test.

Volatile acids in the final effluent were as follows: First test run, average 27 ppm, maximum 58 ppm, minimum 14 ppm; second test, average 25 ppm, maximum 45 ppm, minimum 10 ppm; third test, not reported. Settleable solids in the effluent in the second and third tests were, respectively, 25 and 29 ml per liter.

The low production of gas in the third test is believed due to the extremely cold weather. Gas produced on the three tests shows that 9 btu are produced per pound of raw feed.

During the tests the volume of sludge in the digester varied from 18% to 35%. The optimum amount of sludge was not determined, but it is believed that satisfactory results can be obtained with a sludge volume varying from 12.5% to 50% of the digester capacity.

The volume of the digester is used in calculating detention time and per cent removals. It appears that the digester is the main reacting center and that the function of the holding tank is to retain the raw waste so that it can be fed to the digester at a uniform rate. The primary purpose of the settling tank is to collect the sludge so that it can be returned to the system. Preinoculation of the raw waste with the sludge appears to produce a reaction that speeds subsequent digestion.

This article is based on the original paper presented by Messrs. Fullen and Murphy at the Research Conference of The American Meat Institute.

● ***START of job. with motor grader windrowing material onto street for better pulverizing.***

● ***GRID roller pulverizing the old surfacing material for incorporation in new pavement.***

GRID ROLLER REDUCES ROAD SALVAGE TIME

ON a job where time was an essential factor, a grid-type roller was used in a dual capacity to salvage an old bituminous street. The grid roller, made by the Hyster Co., was used as a breaker to pulverize the scarified material, and also as a roller to compact the base and the replaced road material as well.

The job consisted of reclaiming the old bituminous surface of a two-block section of Irwin St., in Hanford, Calif. The two blocks totalled about 800 ft. long and the surfacing was 40 ft. wide. Plans required that the old surface be scarified, the surface material pulverized, the base compacted and the salvaged material relaid, with added necessary binder and cover. Work began on Friday morning and the schedule of operations contemplated a completed new surface in time for the week-end heavy traffic. This schedule was carried out.

In addition to the grid roller, a Caterpillar D7 crawler tractor, a Caterpillar motor grader and a tandem, smooth-wheel roller were available for the work.

● ***FINAL phase of the job: Laying the surface courses.***

Procedure in Construction

The old surface was scarified, this procedure being restricted to half of the street width in order to reduce inconvenience to street residents. The scarified material was then pulverized by the grid roller. Towed by the tractor, and weighted to a total of 20,000 pounds, the roller reduced the scarified pieces to the size of the original aggregate in six to eight passes, though many of the torn-up pieces were initially 4 to 7 ins. thick and 12 ins. or more in diameter. To speed up the process, some of the material was windrowed onto the existing surface by the motor grader, the firm surface of the old pavement aiding in quick reduction of the pieces under the roller.

After the scarified material had been pulverized satisfactorily, it was bladed off the base by the motor grader and the grid roller was then used to compact the base before replacing the reclaimed material. Following this, the original surfacing, now reduced to aggregate size, was bladed back onto the base and spread in 2-inch lifts, each lift being compacted before the next lift was spread. The fourth and last lift was compacted by the tandem roller following the application of binder and cover material.

Saturday traffic found a new section of road and the work was done with marked savings in both time and cost by efficient use of equipment.

Mobile Laboratory for

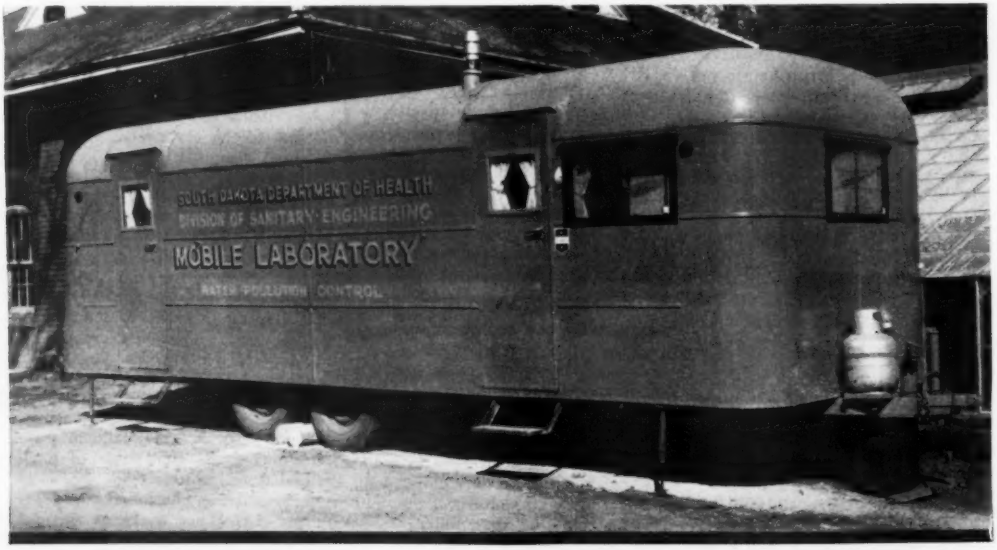
THE mobile laboratory unit of the Division of Sanitary Engineering of the South Dakota Department of Health is designed to facilitate stream pollution activities, industrial waste studies, and laboratory control of water and sewage treatment plants. It includes the necessary laboratory equipment and supplies to make all usually required chemical, bacteriological, and biological examinations.

A standard house trailer fitted with laboratory facilities and equipment was considered to be the most efficient and economical type of mobile laboratory. The primary unit is a conventional 22½-foot Schult trailer house with no interior cabinet work or partitions, but with an oil burning type of space heater, special 110v AC wiring for electrical laboratory equipment, and a 2-wheel dolly. The basic trailer had two doors on one side, screened windows, three roof ventilators, and tandem wheels. Water and electrical connections are provided on the exterior of the trailer and necessary garden hose and outside electric cable were supplied to provide connections between the laboratory and sources of water and electricity when the unit is operative.

Facilities in the Trailer

After the basic unit was procured, plans were prepared by the Division of Sanitary Engineering for cabinets, counter and drawer space along each side and across the front of the unit. The rear of the trailer was left vacant and a cot can be placed there if the operating crew is in the field on a twenty-four hour sampling schedule. The trailer is fitted with interior cabinets, masonite counter tops, self-locking drawers, two built-in water tanks, electric water heater, laboratory sink with water and waste connections, and bottle gas lines and outlets. The water tanks are directly above the sink and provide storage for both distilled and tap water. The distilled water tank is of aluminum and the ordinary water tank of galvanized iron. The interior water piping from the hose connection to the sink has been arranged to bypass the water storage tank if desired. Cabinets are constructed of plywood and stained to match the interior finish of the walls. Counter tops are masonite painted with several coats of acid-alkaline resistant plastic paint.

A combination refrigerator and 20°C air bath Biochemical Oxygen Demand incubator is built over one of the wheel housings and to the same height as the base cabinets, thereby providing additional counter area. The refrigerator-incubator is constructed as a single unit and divided by an insulated partition. A standard refrigerator compressor, equipped with the required dual controls serves both the refrigerator and incubator, and an ordinary light bulb with controls incorporated with the refrigerator thermostats acts as a heating element in the BOD incubator. The installation of sensitive thermostatic controls limits the total temperature variation to less than 1°C; however, one of the control devices, a mercury controller switch, was found to be too sensitive for use in a mobile unit because the



● **EXTERIOR view of 22½-ft. long unit as set up and ready for stream pollution studies.**

Water Pollution Control

● ***INTERIOR** of the mobile laboratory is shown in this view, with the equipment ready for use.*

slightest movement in the trailer causes the solenoid valve to flutter. The replacement of this control with a bi-metallic-type of thermostat is contemplated.

Other Laboratory Equipment

The remainder of the laboratory equipment is conventional in type, thereby reducing the expense of costly built-in units. Two bacteriological incubators, each with temperature ranges from 37°C to 45.5°C, provide sufficient flexibility in the performance of both the coliform and enterococcus examinations. Other equipment, including a muffle furnace, laboratory gas stove, balances (beam and chainomatic), and drying oven, is secured to the cabinets to facilitate moving. A 22-quart pressure cooker, fitted with pressure and temperature gages, is utilized as an autoclave and a kerosene stove oven as a dry-air sterilizer. Additional equipment includes a water still, mechanical aspirator, pH meters, turbidmeter, glassware, and other miscellaneous items and supplies necessary for the various types of laboratory studies that may be performed.

The mobile laboratory was first put into operation in October, 1950, on a combined stream pollution and industrial waste survey in the Black Hills area. Satisfactory operational results during this initial survey and subsequent related field work indicated that the unit is well adapted to the conditions existing in South Dakota. Although temperatures as low as —15°F. were encountered during winter field work, working conditions were not seriously impaired and the laboratory facilities functioned satisfactorily. No major difficulties were encountered in the operation of the laboratory equipment; however, the existing stationary supports do not prevent movement of the unit. The installation of additional stabilizing jacks along the length of the trailer or the use of a heavier type of support may remedy this condition to some extent.

The prime mover for the mobile laboratory has been a 1947 Chevrolet coach, equipped with overload springs, a special trailer hitch, and necessary connections for the electric trailer brakes. Some difficulty has been experienced in moving the loaded laboratory with this type of automobile. It is felt by the Division personnel assigned to this unit that the laboratory is too heavy and cumbersome for this automobile and it is anticipated that a heavier prime mover will be procured. The Division prefers a passenger-type car rather than a truck, inasmuch as the tow-car will be used as a multiple-purpose automobile, as for the collection of samples and general transportation of personnel when the mobile laboratory is not in use.

The mobile unit was designed and constructed under the supervision of R. J. Stapf, Chief, Sewage Section, Division of Sanitary Engineering; W. W. Towne, former Director, Division of Sanitary Engineering; and Charles E. Carl, Director, who succeeded Mr. Towne, November 1, 1949. The total cost of the laboratory unit excluding the tow car was $5050, which can be broken down as follows: (1) stripped trailer coach, $1800; (2) cabinets and miscellaneous equipment, $1200; (3) combination refrigerator and BOD incubator, $850; (4) laboratory equipment, glassware and supplies. $1200.

HOW WE SOLVED OUR DIGGING PROBLEMS

H. A. GILBERT

Corry Water Supply Co., Corry, Pa.

WHEN our water system was constructed **65 years ago, men** with picks and shovels, with perhaps some horsedrawn scrapers did the work, and they did it with some speed. Between Aug. 1 and Sept. 14, 1886, 5 miles of pipe were laid. But times have changed. Years ago, it was possible to go over to the corner of Main and Center Streets and find half a dozen men ready to do a job of digging. Now with the State Employment Service in that location, we are told no one is looking for that kind of work. So we have to turn to machinery, and we find it is cheaper and quicker and has many other advantages.

In mid-summer of 1950, we sent some men to attend a demonstration of a Sherman Digger attached to a Ford tractor. They reported favorably and we took a machine that was available for spot delivery. Its operation has been so satisfactory that it is a pleasure to report what it has done.

Tall Claims by the Operator

The machine will not break through ledge rock but it will cut through ordinary soft shale and it will dig in gravel containing boulders and do it without complaint. It will dig in loose clay but in harder clay, we find a man has to ride the bucket for it to get a good bite. Our machine will cut to a depth of 5 ft. The newer and more powerful models will cut to a depth of 8 ft. and will handle hard clay without a man riding the bucket. We can handle ground frozen like cast iron by using a frost wedge and pavement breaker ahead of the digger.

Our operator claims that he can pick up his watch with the bucket, but that is not saying the watch would keep very good time after it was picked up. However, our digger will go right down to a cast iron main and skin the tar off without breaking the pipe.

On ordinary service box excavation work, we used to put a man on the job with pick and shovel, and arrange to pick him up at noon, expecting to find the curb box dug up ready for the job to proceed. The Sherman digger will dig up the curb box in twenty minutes—or half an hour, if the going is tough. We can dig right down, skimming the dirt from the side of the box, and then loosen it with a pick. The machine can be so closely controlled that we never break the box.

In January, we dug a service trench through mud, encountering ground water almost at once. Work

● ***BACKFILLING is another job our machine does well.***

by hand, under these conditions, would have been almost impossible and would have been postponed. Our digger took only three hours to put in 100 ft. of copper tubing. Time of all persons engaged on the job of excavating through five feet of mud and water and installing and connecting the pipe was 9 hours, using 3 men.

Some Work Data

In summer weather, we went 97½ ft. through partly made ground in 2¼ hours digging time and with 12 hours total labor. We went 56 ft. through filled-in soil containing rocks 8 to 10 ins. in diameter in 2½ hours digging time, and the total

● ***SOFT mud does not slow down work with the Digger.***

labor time required was 20 hours, including pipe laying and backfilling. On another service, we laid 57 ft. in 2 hours digging time with a total of 12 hours of labor. Two other jobs showed 45 ft. in one hour and 26 ft. in one hour. With the ground thawing and loose clay to work in, we laid 75 ft. of tubing in loose clay in 1½ hours digger time and 13 hours labor time. Time required depends, of course, on soil conditions, location and, probably to some extent, the weather, with every job presenting its own set of conditions.

An advantage of good equipment is that it permits guaranteeing steady employment every month of the year to a small but experienced crew. Men will tackle any job and will work better on it if they have efficient tools. In this city of about 8,000, our equipment includes a ½-ton and a 1-ton truck; a Ford tractor with crane and power winch; 2 Homelite pumps; a Greenlee pipe pusher; a 60-ft. Chicago trailer-mounted compressor, with six air tools; a small trailer and a large trailer for carrying pipe; a Sasgen tripod derrick; a Coffing 1½-ton ratchet hoist; a small concrete mixer; an electric lighting plant for night work; Caine corrugated piling with special sheeting driver and jacks; plus our Sherman digger and the usual assortment of tools for pipe laying and maintenance.

What we need now are more customers.

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Clear across the country, more and more progressive-minded civic leaders are adopting the new, more hygienic method of garbage disposal —the General Electric way.

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In Jasper, Indiana, for instance, installation of G-E Disposalls is already complete in two-thirds of all homes. The city's garbage collection service has been suspended.

In Herrin, Illinois and Mount Dora, Florida, whole groups of fortunate housewives—thanks to municipal action—have joined the ranks of more than 250,000 G-E Disposall users. They now wash away *processed* food wastes—simply by turning the kitchen faucet.

If *you* are in any way concerned with civic planning or sewage treatment, now is the time to consider how the G-E Disposall, perfected by 15 years of pioneering and improvement, can bring new convenience and better health to your community.

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Saving precious water for a thirsty

Municipal consumption of water in the United States has risen from two billion to over twelve billion gallons per day in the last fifty years.

In many areas, this rapid increase is posing a serious problem. It means that water supplies must be conserved to the limit if they are to continue to meet an ever-growing demand.

It is not surprising, therefore, that more and more water-works officials are seeking ways to cut down on water losses as one practical step toward the solution of this problem.

Since recent studies indicate that many localities are losing as much as 10% of water pumped because of underground leakage, an important question to be answered in any water conservation program is this: "How can I plan to reduce this major cause of water loss to a minimum?"

Community after community has found the answer in Transite Pressure Pipe.

The unusual success of Transite Pipe in combatting underground water losses is due to a combination of two factors: (1) the design of the Simplex Coupling used for assembly, and (2) the ability of the pipe to maintain its strength in service.

Because flexibility is engineered into the Simplex Coupling, this factory-made joint is virtually unaffected by pipe line stresses that so often result in the loosening and failure of conventional type joints. No particular skill is required for its proper assembly, which is readily checked in the trench by means of a simple gauge immediately after the pipe ends are joined.

Moreover, Transite's maintained strength provides a further safeguard against costly underground water losses. In thousands of installations representing a wide variety of municipal soils, this asbestos-cement pipe has proved its exceptional ability to resist corrosion . . . to maintain its strength under conditions which have seriously impaired the structural integrity of other pipe materials.

Reducing the amount of "water pumped but not paid for" on your books—a saving in dollars as well as water—is only one of many important economies which Transite Pipe can offer you. Savings on installation, savings on pumping costs, savings on maintenance . . . these are further sound reasons why you will want all the facts about this modern asbestos-cement pipe developed and produced by Johns-Manville to carry water more efficiently.

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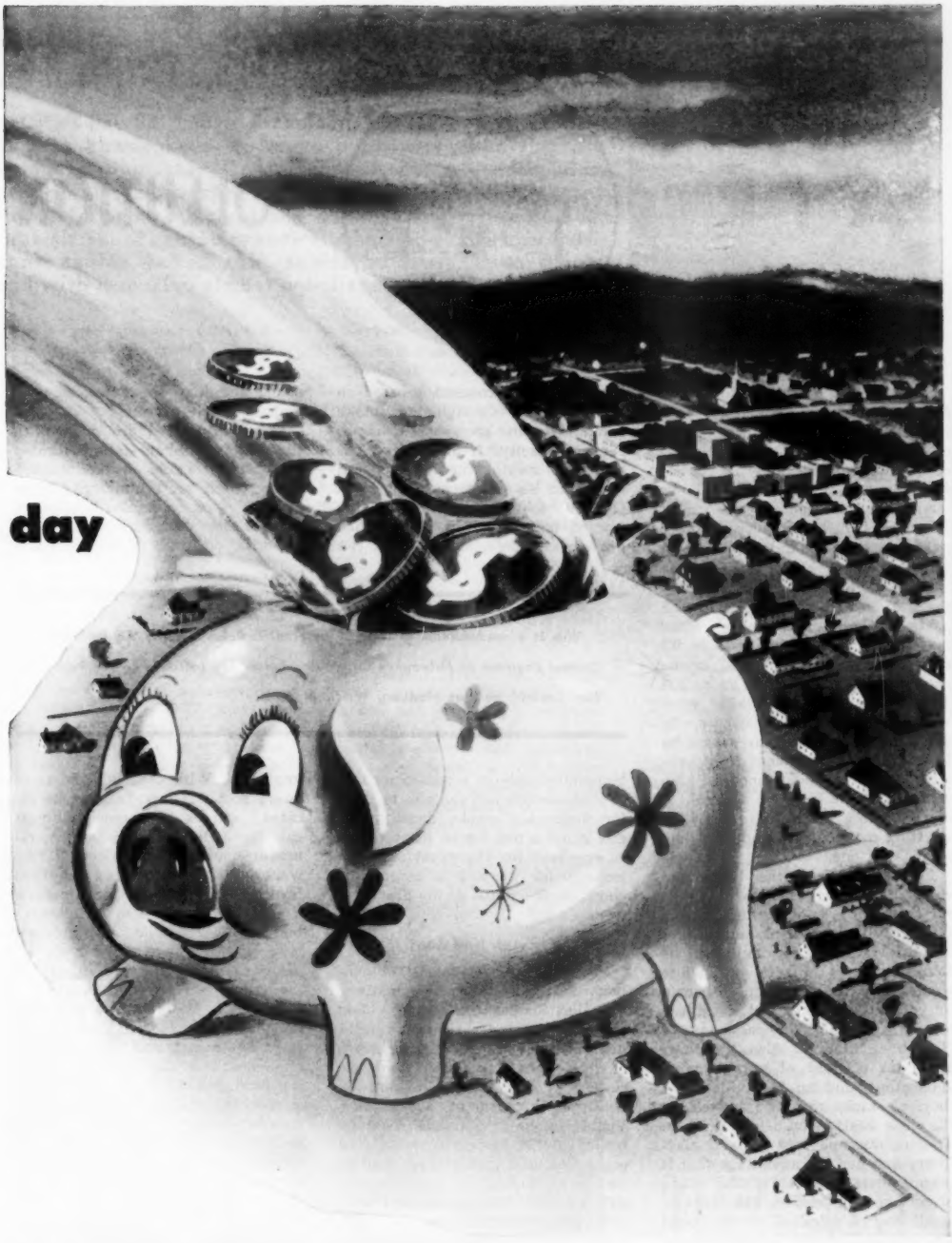

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HOW TO MEASURE AIR POLLUTION

This is a condensation of a paper by Fred R. Rehm, Deputy Air Pollution Control Engineer of Milwaukee Co., Wisc., before the Institute on Air Pollution Control, held at Madison, Wisc., in April.

ACCURATE measurements of impurities in the atmosphere is fundamental to the application of corrective measures. The cause of trouble must be determined before plans for elimination can be made. Air pollutants, as a whole, fall into two broad classifications, particulate matter and gaseous matter.

Smoke, which is classified as particulate matter, consists of carbon particles, hydrocarbons and other tars in the size range 0.001 to 0.3 micron. In most cases, the smoke problem has been given an undue amount of attention while other real pollutant trouble-makers, fly ash and soot, have been passed by because of the problem they present in measurement, and the high costs involved in their control. A clean-looking stack may easily be emitting more fly ash and soot than a smoking one.

For fifty years, the Ringelman chart has been used as a gauge for measuring smoke emission, and most cities having smoke ordinances use this device. Many faults can be found with it. Black and white shades only can be measured; brown or yellowish smoke, just as objectionable, cannot be assigned a Ringelman number. Also, the chart takes no account of volume considerations, and an 8-ft. thick column of smoke must be judged on the same basis as an 8-inch column. The umbrascope uses smoked glass filters and has the advantage that it permits determination of the shade of an emitted smoke. The unit is small, easily handled, costs about $30 but is subject to damage in handling.

Los Angeles County measures smoke other than black and white shades, which are measured with a Ringelman chart, on an opacity basis. The measurement is based on ability to see through the smoke column. Results are reported as per cent of opacity. A disadvantage is that the inspector must be prepared to defend his judgment on opacity. On the other hand, this is a step toward measuring off-color smoke discharges which, at this time, can be handled only on a nuisance basis. A photoelectric cell can also be used for measuring smoke density, but this is not a tool for an inspector; it is excellent for the plant superintendent for keeping a continuous check on the status of the discharge from a stack.

Fly Ash and Soot

Fly ash and soot consist of carbonaceous and silaceous matters, metallic oxides, sulphates and chlorides in the size range of 1 micron and up. It is in the control of this type of pollutant that the success of a smoke control and air pollution department really lies. Visible smoke emission can be controlled quite easily by specifying equipment and type of fuel, and by education, but these requirements will not eliminate fly ash and soot.

To attack this problem, two separate classes of tests are needed. One concerns the accurate measurement of the general fly ash and soot fall of the community. Having this information, it is then necessary to examine the discharge from specific stacks and ducts so as to reduce the emission at its source.

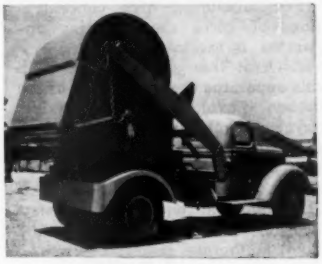
Dust-fall studies are made with the aid of sampling stations located in various sections of the municipality. There are a number of types of these—jars containing a solution, glass slides coated with adhesive material, electrostatic samplers and impingers. With their aid, areas of heavy soot and dust fall can be located, sources of these pollutants can be indicated and a general measurement of the effects of the work is possible. In this connection, tests are being made to determine if the rate of corrosion of low carbon steel, copper and S-2 aluminum may not furnish as reliable an indication of the deposition rate as the samplers mentioned above.

Once the areas of heavy pollution have been located, it is necessary to investigate the suspected offenders. Two items of information are fundamental in determining the dustloading of an emitted gas. First, it is important to get the accurate weight of a collected sample; and second, it is necessary to measure accurately the volume of the gas in which this collected sample was contained. This presupposes that a representative sample of the discharge is taken into the sampler. In performing these dustloading tests, it is impossible to be too particular. The results obtained from them may force the expenditure of many

DEMPSTER-DUMPSTER RUBBISH COLLECTION

What It Is—How Cities Use It To Cut Costs, Increase Cleanliness

Cities like Baltimore, Richmond, Nashville, Boston, Cincinnati, Birmingham—to name a few—are spotting big Dempster-Dumpster Containers at Schools, Hospitals, and Hotels . . . Apartment, Housing, Business and Market Areas for more efficient and sanitary collection of bulk rubbish. These containers are eliminating unsanitary trash cans, crates, boxes, rats, scattered trash, open trucks and with it making almost unbelievable savings.



PICK UP AND HAULING OPERATIONS are shown in the two photos above. Driver backs Dempster-Dumpster up to Dempster-Dumpster Container, which has been pre-loaded by user, slips lifting chains onto lugs at each end of container, then, by hydraulic controls in the cab, lifts container into carrying position and drives to disposal area.

Here is a brief explanation of this revolutionary method of bulk rubbish collection:

Operated By One Man

The Dempster-Dumpster System is, simply stated, one or more truck-mounted Dempster-Dumpsters, each with only one man, the driver, servicing any required number of detachable Dempster-Dumpster Containers, ranging in size up to 12 cu. yds. The Dempster-Dumpster makes scheduled calls at housing, market and business areas, hospitals, schools, etc. and picks up each pre-loaded container, hauls it to disposal area where contents are dumped automatically, then returns container to replace another pre-loaded container. This single truck-mounted Dempster-Dumpster services any number of containers, one after another.

The cleanliness of the Dempster-Dumpster System is due to the completely closed steel containers. Trash and refuse cannot be scattered over streets and alleys by winds or scavengers. Dempster-Dumpster Containers are fire-proof and rat-proof.

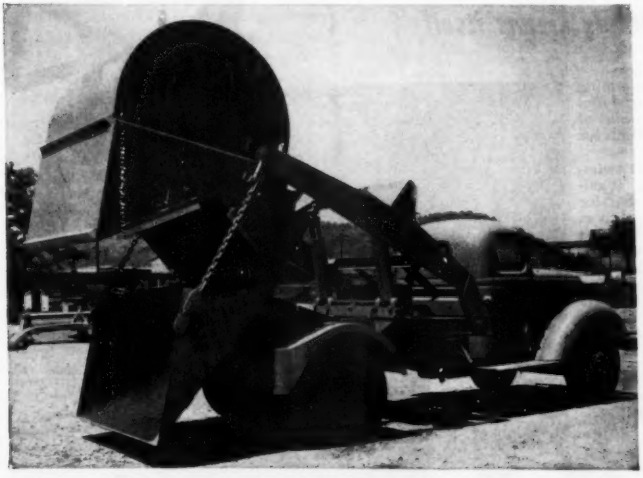
System Grows as Needed

The City of Birmingham started out with one Dempster-Dumpster and 10 containers in 1938. Now Birmingham has 12 Dempster-Dumpsters servicing 204 containers. Richmond, Va. started out with two Dempster-Dumpsters and 13 containers in 1946. Today Richmond has six Dempster-Dumpsters servicing 196 containers. And so on down the line in city after city where the Dempster-Dumpster System is saving sanitation departments thousands of dollars annually. For example, when Richmond replaced the conventional open truck method of bulk rubbish collection in the business area with the Dempster-Dumpster System it cut collection costs from $1.03 to .43 per cubic yard.

The pay-load capacity of the larger Dempster-Dumpster Containers is equal to or greater than conventional truck bodies. It is important to remember that containers are available in many different designs of every desired size. For instance, where moist or wet rubbish is a problem, a Dempster-Dumpster container is built to take care of it. And bear in mind, regardless of the different designs or sizes of the containers you use at various points, one truck-mounted Dempster-Dumpster can service them all.

The Dempster-Dumpster System triples man-hour efficiency . . . reduces truck investment, gas, oil, maintenance costs . . . improves "housekeeping" methods . . . reduces fire hazards . . . provides an easier, quicker, safer and more effective manner of handling bulk trash and refuse.

Upon request Dempster Brothers engineers will be glad to prepare, at no cost to your city, a complete report for your particular municipal bulk rubbish collection requirements to determine the extent to which the Dempster-Dumpster System would justify its purchase and just what equipment would be required for efficient bulk rubbish disposal.



DUMPING POSITION of this 10 cu. yd. Apartment Type Dempster-Dumpster Container is shown above. Its payload capacity is greater than the average conventional truck body. Container is placed in dumping position hydraulically and drop bottom section of container is lowered for dumping . . all under complete control of driver in the cab.

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thousands of dollars, for in most cases that is what it costs for efficient collection equipment to reduce the dustloading to permissible values.

There are various ways of plotting the results of the collections of airborne dust, as tons per square mile per month, grains per cubic foot at an adjusted air temperature, or pounds of dust per 1,000 pounds of flue gases adjusted to 12% carbon dioxide reading. Los Angeles County has set up a table of permissive amounts of discharge which covers all types of equipment and processes.

Gaseous Pollutants

For measuring high concentrations of gases the following apparatus is available:

1. Orsat flue gas analyzer. With this apparatus the percentage of the carbon dioxide, carbon monoxide, oxygen, combustible gases, hydrogen and others can be determined. This apparatus is very useful, primarily to adjust the fuel-air ratio of combustion equipment to stay clear of smoke and yet not suffer from a thermal efficiency standpoint.

2. Devices that continuously sample and record the concentration of oxygen and carbon dioxide of flue gases of combustion equipment. These instruments are more of a stationary type and are not the readily portable type instruments needed by an air pollution department. These instruments, as a rule, use a conductivity cell and electrical circuit as the analyzing medium.

3. Some of the absorption techniques used in determining trace concentrations of gases may also be used to measure high concentrations.

For measuring trace concentrations of gases, the following methods can be used:

1. The most widely used method of determining trace concentrations of gaseous matter is by means of impingers, absorption bottles, V-tubes with solid absorbents, fritted glass disks, etc., and using the absorption principle to isolate traces of specific contaminants. In this regard the selection of the correct absorbent is of utmost importance. Examples of some of the gases collected in this way are aldehydes, sulfur dioxide, oil vapors and hydrogen sulfide.

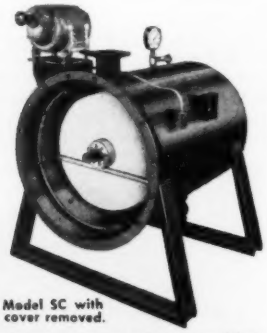
In almost all of the above absorption methods of trace gas analysis, colorimetric or chemical analysis methods are used to measure the quantity of gaseous material absorbed.

2. The adsorption method using silica gel or activated charcoal is adaptable to determining most solvent vapors, such as lacquer fumes, etc.

3. Direct reading colorimetric devices available commercially are expensive but most desirable. An example of this type instrument is the carbon monoxide detector. There are other such instruments for many types of gases. Cyanides, hydrogen sulfide, sulfur dioxide and methane are some of the pollutants that can be determined with these devices. It is possible to measure very low concentrations of gaseous matter with these devices.

The absence of acceptable standards of permissible concentrations of these gaseous pollutants is another important need of the air pollution personnel. Individual toxicity tolerances have been set for many of the harmful gases and until something better comes along, these tolerances must be followed. What has never been determined satisfactorily is just what the synergistic effect of

NOW A SELF-CLEANING DIATOMITE FILTER FOR ANY LARGE VOLUME WATER REQUIREMENTS



Model SC with cover removed.

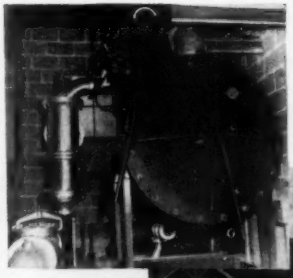
SPARKLER Model SC *completely cleans itself in just a few minutes*

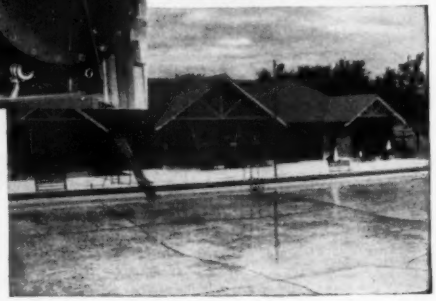
The Sparkler Model SC filter is ideal for swimming pools, municipal water systems, or large industrial uses because it provides a low-cost, self-cleaning means of filtration that meets the most exacting requirements for health and purity.

On the installation pictured here—a typical swimming pool—recirculated water from the 368,000 gallon pool consistently tests as class A—suitable for drinking. Both Enterococci MPN count and coliform MPN count are always less than 3, despite the fact that the pool carries a very large load of swimmers daily.

In the Model SC, which is a diatomite filter utilizing hollow discs covered with prefabricated media as the filter element, design and construction eliminate by-passing and channeling. Cleaning of the filter is accomplished by a simple but positive mechanical means that employs an opposed set of nylon brushes to clean both sides of each disc. Then, only a minimum amount of wash water is needed to carry away the discarded cake.

Model SC filters are available in sizes from 15 sq. ft. to 300 sq. ft. A Sparkler Field Engineer will be glad to discuss your particular problem with you.





368,000 gal. pool at Red Wing, Minn., equipped with Model SC filter operating on a one week cleaning cycle. Entire installation is in 13' x 17' area.

SPARKLER Integrated Plan FILTERS

Write for detailed information and typical plans.

SPARKLER MANUFACTURING COMPANY

Mundelein, Illinois

Manufacturers of precision filtration equipment for more than a quarter of a century.

these various toxic gases is on a human being. This information is needed before a final set of gaseous limitation standards can be accepted. A good example of this synergistic action is the smog problem in Los Angeles. During 3 years of research, investigators have found that no one single gas or vapor present in the quantity found in the city's atmosphere will produce eye irritation; yet, they have vivid evidence once or twice a year that the mixture of these various contaminants does cause eye irritation.

Material Requirements

(Continued from page 35)

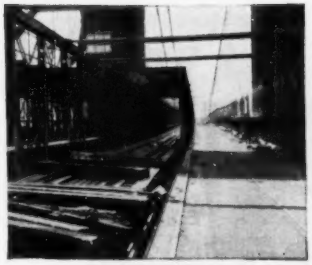
average of 50.4%. This aggregate was made up as follows: Of the 50.4%, 19.0% went for metal products, including reinforcing 5.9%; pipe and fittings 5.7%; hydrants and valves 3.6%; tanks and towers 0.3%; plumbing fixtures 0.7%; and other items 2.8%. Machinery and equipment amounted to 15.1%, of which softening and treating equipment amounted to 4.3%; foundry products 1.9%; meters, regulators and gauges 2.0%; and electrical equipment, wiring and fixtures 3.6%.

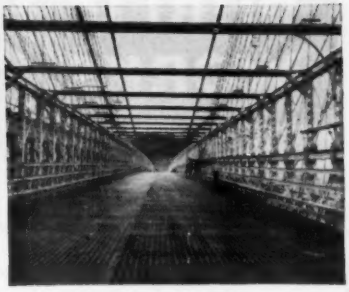
Metal products and machinery and equipment together represented 34.1% of the total cost, but it must be remembered that the cost for machinery and equipment contains a considerable proportion of labor employed in its fabrication and design, as well as transportation and sales costs. Stone, clay and glass products aggregated 13.4%, including brick 1.2%; concrete 9.2%; and aggregates 1.1%. Lumber products were 1.3% of the total; and other materials 1.6%.

Labor costs were 30.1% of the total; overhead, profit and equipment charges were 17.6%; and supplies, including small tools, fuel and explosives were 1.9%.

Bituminous Contractor Uses 2-Way Radio

In the coordination of many jobs, and in keeping equipment and men moving, A. L. Blades & Sons Const. Co., Hornell, N. Y., has found 2-way radio to be valuable. Delays in placement of surfacing, due to equipment breakdowns or from other causes, can be reported promptly to the bituminous mixing plant, stopping the flow of hot stuff, which might otherwise be a total loss.





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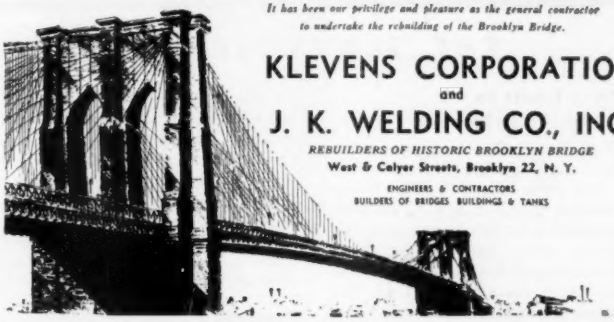

It has been our privilege and pleasure as the general contractor to undertake the rebuilding of the Brooklyn Bridge.

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Where no vegetation whatever is desired such as your parking places and walks. Penetrates deep down to plant roots and *kills*. Sterilizes the soil, preventing normal sprouting of wind-blown seeds. Weeding the thorough, modern *chemical* way eliminates backbreaking toil and saves the cost of many labor-hours.

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PUBLIC WORKS DIGESTS

THIS section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of all principal articles in these publications.

SEWERAGE AND REFUSE . . 58
HIGHWAYS AND AIRPORTS . . 64
WATER WORKS . . 68

THE SEWERAGE AND REFUSE DIGEST

Setting Limits to Wabash River Pollution

A survey made with the cooperation of nine organizations, sponsored by the Ohio River Valley Water Sanitation Com'n, has been made to determine how much pollution the Wabash river can receive from Terre Haute and Vincennes and still insure that the average 24 hr. DO content of the river water shall not be less than 50% saturation more often that once in ten years during the week of minimum flow. It was estimated that treatment at Terre Haute must take all of the settleable solids out of the city's domestic and industrial wastes and reduce their BOD at least 25%; and Vincennes must remove almost all of the settleable solids. To reach this conclusion, the survey consisted of collection and analysis of hydrologic, waste-discharge and water-quality data, and statistical evaluation of collected facts in terms of regulatory requirements. This involved forecast of dissolved-oxygen conditions in the river under various drought probabilities, pollution loads and water-quality objectives. Minimum *weekly* average flow of the river was selected because pollution takes about a week to pass through critical (oxygen-depleted) reaches of the river at low flow. Consideration was had of the probability that drought would occur during weeks of high temperature. It was estimated that the ultimate oxygen demand of the sewage wastes from Terra Haute would be 51,500 lb. per day, and of the industrial wastes 101,000 lb.; while at Vincennes the total OD would be 32,300 lb. To determine the capacity of the river to purify wastes, intense sampling of the river water was carried out and tests made for DO and BOD, and studies made of algae, plankton and bacteria and of turbidity and other physical characteristics.

"How Much Pollution Can a River Take?"; *Engineering News-Record*, May 24.

Treatment Of Dye Wastes

In the treatment of industrial wastes, the removal of color from dye wastes is particularly difficult. Most dyes resist oxidizing agents and aerobic digestion. The use of fuller's earth and activated bauxite as adsorbents was investigated by the Attapulgus Clay Co. They were found effective, but economical use of them would require regeneration and reuse. Burning is practical for dyes that contain no metallic constituents. The regeneration of adsorbents by means of solvents or salt solutions, with subsequent recovery of dye, has been found feasible for some dyes.

H. A. Thornton and J. R. Moore—"Adsorbents in Waste Water Treatment—Dye Adsorption and Recovery Studies;" *Sewage and Industrial Wastes*, April.

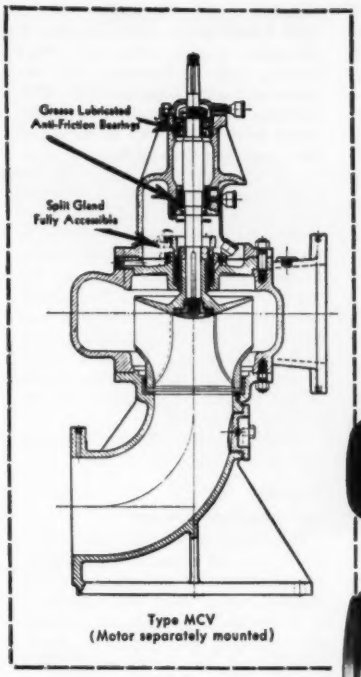
Refuse Disposal In Los Angeles County

Under a program inaugurated by the Board of Supervisors of Los Angeles Co., Calif., operators of refuse disposal sites in unincorporated territory must obtain a waste-disposal permit from the County Engineer, first obtaining a land-use permit from the county's Regional Planning Commission, posting a faithful performance bond and furnishing a detailed plan of operation prepared by a civil engineer, specifying the type and size of mechanical equipment and methods of operation to be used. The method must conform to strict regulations for "cut-and-cover" or "continuous fill and cover" operation.

C. E. Arnold—"Why Los Angeles County Adopted Cut-and-Cover Refuse Disposal;" *American City*, May.

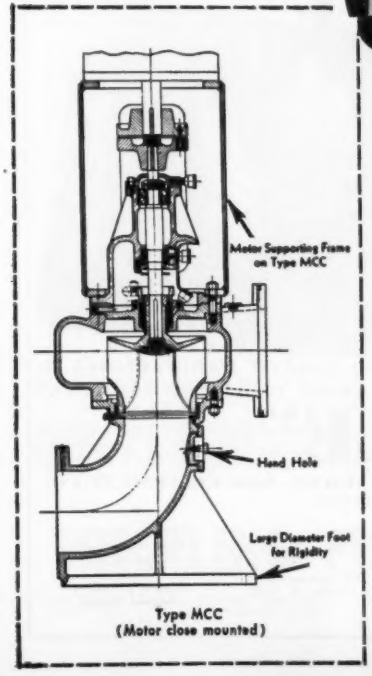
Repairing Sewers By Relining With Cement

Of storm sewers laid in West Palm Beach, Florida, in 1923-1926, about 18,000 ft. of 30″ to 60″ were found in 1949 to be in immediate need of repairs because of joint openings and cracks and in some cases almost complete collapse. Attempts were made at patching, replacing with corrugated pipe, and threading smaller pipe into defective sewers, but none of them was satisfactory. A 30″ vitrified clay pipe was broken in the laboratory and the broken pieces put together again and gunited with a ⅜″ cement lining and after 7 days was tested for strength, which was found to be about 25% of that before breaking. Such additional strength would probably prevent further deterioration. Guniting, however, was considered impractical in pipe smaller than 60″, and a contract was made with the Centriline Corp. to place a ½″ lining of portland cement in the 30″ pipe and 1″ in the larger sizes at prices ranging from $2.80 per foot for 30″ pipe to $5.80 for 60″. The city forces were to clean, desand and



Type MCV
(Motor separately mounted)

Mixflo, Type MCV
with base elbow suction nozzle



Type MCC
(Motor close mounted)

There's a Mixflo Pump

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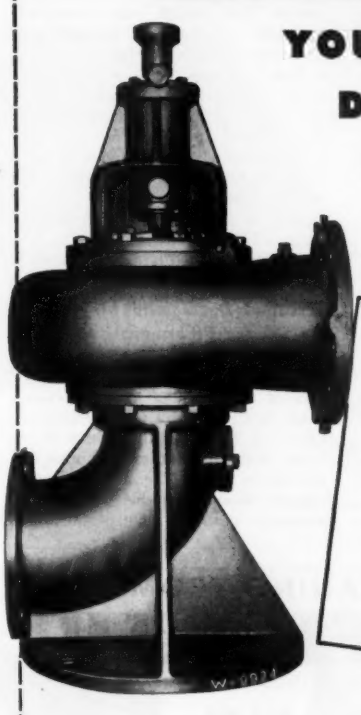
Exactly!



Worthington Offers The Largest Selection Of Sizes And Types In A Single Line

Non-clogging two-vane closed impellers, grease-lubricated anti-friction bearings, easy accessibility to the split stuffing-box gland and impeller eye . . . are typical of the many Worthington Mixflo features assuring low-cost, trouble-free sewage pumping.

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And along with performance-proved excellence in every mechanical and hydraulic detail, the Mixflo line offers you the widest choice of sizes and types in the field. So there's no need to compromise on a pump that's "about" right — you're sure to find a Mixflo that's *exactly right* for your particular requirements.

Bulletin W-317-B16 describes the various Mixflo types made in 10″, 12″ and 16″ sizes. Worthington also builds Mixflos in sizes up to 84″, with open or closed impellers and for horizontal or vertical drives. For more Mixflo facts that prove *there's more worth in Worthington*, contact our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Harrison, N. J.*

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dewater the sewers, but this soon proved to be an unsatisfactory arrangement and the Centriline Corp. did this on a cost plus basis, at a cost of about $2 to $3 a foot. Placing the cement lining necessitated elimination of infiltration until the cement had set, and this was effected by forcing quick-setting grout through the wall of the sewer, or by caulking with oakum. The work proved so successful that the 1950-51 budget contained approximately $70,000 for continuing the work.

Sidney Lickton—"How Storm Sewers Were Relined and Repaired;" *PUBLIC WORKS*, June.

Treatment of Pyrophosphate Wastes

Experiments with high calcium lime, dolomitic lime, sodium hydroxide and other alkalies to treat copper pyrophosphate plating wash water showed that copper could be removed from the wash water to a high degree. Of the alkalies employed, high calcium lime proved to be the most satisfactory, producing high copper removals and rapid settling or sludge separation. The sludge produced can be concentrated by settling for 24 hours to about 50 to 70 gallons per 1000 gallons of waste, and centrifuging reduced the sludge volume to about 10 to 15 gallons. The settled sludge can be readily dewatered on vacuum filters or by filter presses with the addition of lime as conditioning agent. The sludge cake produced amounts to about 40 pounds per 1000 gallons of wash water.

The total cost for lime for 97 per cent copper removal, leaving not more than 1 ppm copper in the effluent, and conditioning of the sludge formed, is estimated to be less than 3½ cents per 1000 gallons of waste treated.

Wm. A. Parsons and Willem Rudolfs—"Lime Treatment of Copper Pyrophosphate Plating Wastes;" *Wastes Engineering*, June.

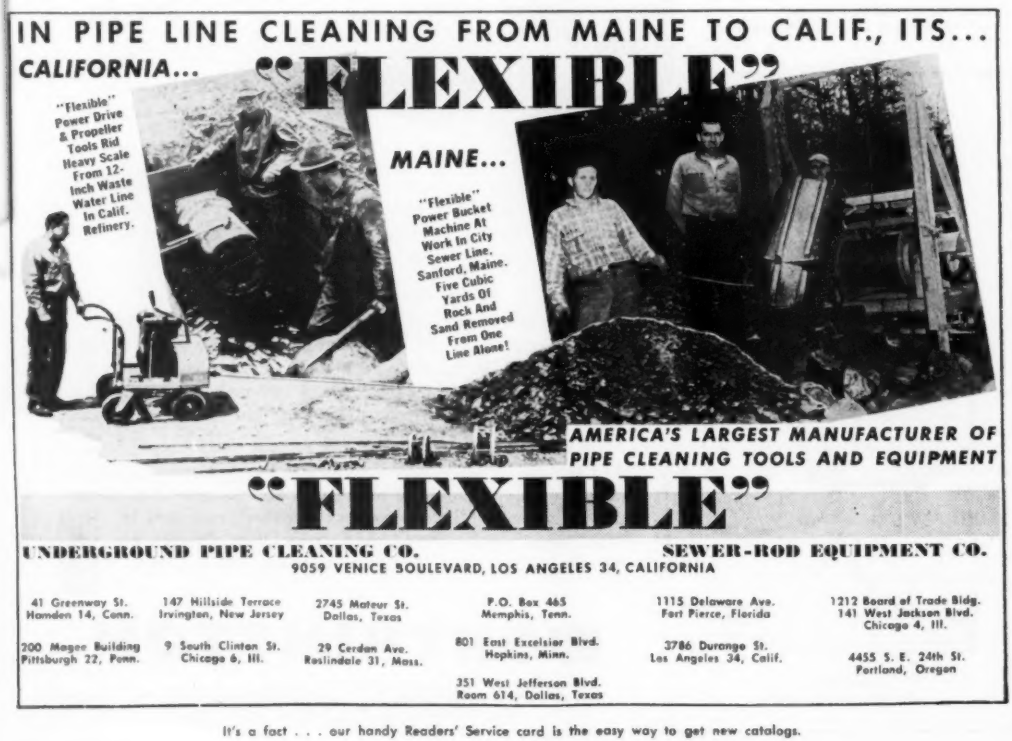
Effect of Detergents On Sewage Treatment

Examination was made by the Lawrence (Mass.) Experiment Station of the effect of anionic detergents in the sewage upon sedimentation in the treatment plant of a small State institution, and also in laboratory tests. The general conclusion seemed to be that, with amounts up to 100 ppm of the detergent, there is normally little if any effect on the sedimentation of domestic sewage. However, other effects, such as foaming, may become seriously objectionable. With increase in the quantities of detergents used which may be expected, they may interfere with absorption, penetration and other effects on biological communities. Several plants are experimenting with "defoamers," of which there are several makes on the market. The foaming seems to have no injurious effect on the activated sludge process. One superintendent found that foaming was always coincident with increase in D.O.; another, that it was greatest, in an aeration tank, at the points where the air was supplied in the greatest quantities.

"1950 Operators' Forum;" *Sewage and Industrial Wastes*, May.

Treating Los Angeles' Sewage

On March 19th, 1951, the entire plant for both primary and secondary treatment of the sewage of Los Angeles, Calif. went into operation. It is designed to treat an average dry-weather flow of 245 mgd., which may be increased to 420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"Flexible" Power Drive & Propeller Tools Rid Heavy Scale From 12-Inch Waste Water Line In Calif. Refinery.
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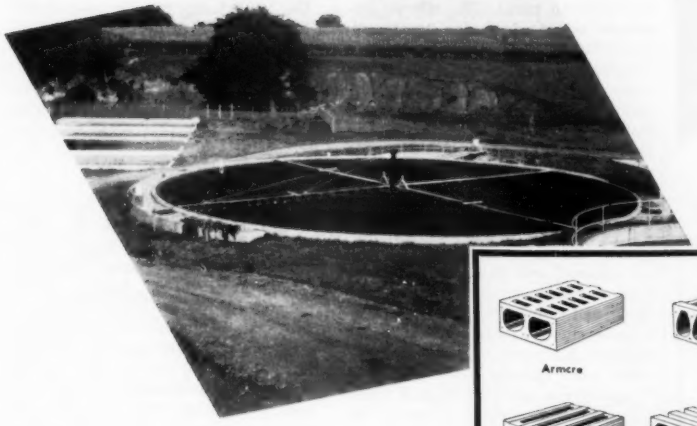
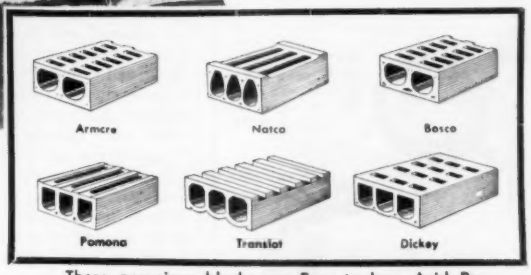


88' PFT Rotary Distributor at new Knoxville, Iowa, sewage plant.



These one-piece blocks are Easy to Lay, Acid Resistant, Proved by Use and Won't Clog

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Trickling Filter Floor Institute *specification* underdrains are used in all modern filters where better results and trouble-free operation are desired. They are scientifically designed for that purpose and made of the finest quality vitrified clay. The size of the top openings insures proper ventilation of all the filter media and free discharge of the filter effluent. The run-off channels are extra smooth for non-clogging, quick drainage.

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On *your* next filter, use the best equipment you can get . . . and give it a specification floor of *Vitrified Clay Filter Bottom Blocks*. Ask any member of this Institute for full engineering details. Write today.

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One of the pioneer makers of equipment for sewage treatment, Pacific Flush Tank Co. has specialized in sewage treatment equipment exclusively since 1893. Its Rotary Distributors are designed to provide a lifetime of dependable service with a minimum of maintenance and replacement. Materials for every detail of construction are carefully selected for their weather, corrosion and abrasion resistant qualities.

Currie Engineering Co. felt that everything that goes with equipment like that should be of equal quality, most of all the floor that is so important for good results. That's why they gave the PFT installation at Knoxville, Iowa, a *specification* floor of *Vitrified Clay Filter Bottom Blocks* . . . the best kind of filter floor available.

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30" butterfly valve for 60 p.s.i. operating pressure; equipped with Janette electric motor operator.

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mgd during a storm. The sewage passes through bar screens, comminutors, detritors; receives pre- and post-chlorination; is pre-aerated and settled for 1½ hr. in covered tanks provided with forced ventilation. The sludge is pumped to digestion tanks. The effluent receives activated sludge treatment, and flows to final settling tanks with unusual effluent weir design, the weir channels crisscrossing the entire surface with a checkerboard pattern. The effluent is carried through a submarine outfall 1 mile from shore and discharged at a depth of 45 ft. There are 6 digestion tanks, 4 primary, heated to 95° F., and 2 secondary. The digested sludge is elutriated, vacuum-filtered and dried in Raymond flash dryers to produce fertilizer, or is burned to ash. The gas is used in 9 supercharged dual-fuel 1688 hp engines, equipped with vapor-phase units and exhaust water heaters. These drive generators and centrifugal blowers. Gas is stored in two gas holders, one a Hortonsphere under high pressure, the other a standard gas holder for low pressure. Surplus gas is burned in a waste-gas burner installation which is probably the largest in the country.

Geoffrey A. Parkes—"Los Angeles Aims at Perfection;" *American City*, June.

Special Design for Large Concrete Sewer Pipe

An interceptor sewer along the Patapsco river is being constructed by the Baltimore County Metropolitan Dist. with some unusual features. It comprises 7050 ft. of 42" and 7180 ft. of 48" reinforced concrete pipe, lined with vitrified clay plates. The plates, during casting of the pipe, are separated by narrow rubber strips, which are removed when the forms are stripped and the joint spaces filled with acid-proof cement. Such cement is also used to fill the joint spaces between pipes after they have been laid. The sewer is laid below mean low tide elevation, in very unstable soil, and special construction features were adopted to prevent settling of the sewer, and a special joint used to maintain tightness should settlement occur. Sheeting was driven to a depth of 42" below the sewer invert and giving a trench 4 ft. wider than the outside sewer diameter. The bottom of the trench was filled with 2 ft. depth of compacted gravel, and on this was laid a platform of two layers of 2" plank to support the sewer. The pipes were made in 12 ft. lengths with t&g joints, in which were used "Tylox" gaskets of rubber composition. In addition, outside the rubber gasket an asphalt belting was caulked into the joint, using regular lead-caulking tools; which belting can be recaulked should a leak develop.

William F. Neale—"Patapsco Interceptor Sewer and Pump Station;" *Water & Sewage Works*, June.

Disposing of Cyanide Wastes

The Boeing Airplane Co. produces many classes of liquid wastes which must be disposed of in such a way as to do no damage to the salmon fishing in Puget Sound, a few miles down the Duwamish River. Their most serious problem is the disposal of cyanide wastes. The most concentrated of these, together with solid toxic wastes, are sealed in leak-proof, non-buoyant containers and dropped into the ocean 100 miles off the continental shelf. Other cyanides are discharged into 3,000 gal. wooden tanks, where hypochlorite is mixed with them for 30 min. The mixture is checked for cyanide with a spectrophotometer, and if no cyanide is present it is dispersed, in a dilution basin, with water pumped from the river, so that the content of the water is less than 1 ppm and the pH is between 6 and 8. The discharge from this basin flows to the river, being checked daily to insure that the pH is between 6.5 and 8.5, nickel does not exceed 5 ppm, fluoride 100 ppm and cyanide 0.2 ppm.

"How to Get Rid of Toxic Industrial Wastes;" *Engineering News-Record*, June 14.

Ascaris Eggs on Sewage-Polluted Vegetables

Vegetables grown on sewage-polluted soils may carry on their surfaces the eggs of worms parasitic to humans. To study the possibility of danger to consumers of such vegetables, suspensions of ascaris eggs and feces were sprayed on grown tomatoes and lettuce, and these examined at intervals afterward. It was found that a reduction of the number of eggs took place with time, but some remained for more than a month. However, completely developed eggs containing motile embryos required for infection were not recovered. Apparently resistance

of ascaris eggs on vegetables is less than might be expected. All eggs degenerated after 27 to 35 days and were incapable of development for infection.

Willem Rudolfs, Lloyd L. Falk and Robert A. Ragotzkie—"Contamination of Vegetables Grown in Polluted Soil;" *Sewage and Industrial Wastes*, May.

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Engineering News-Record

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Florida Water Table Hampers Septic Tanks. May 31, P. 25.

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Test Results on Single-Stage Biological Filter. June, Pp. 70-71.

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Detergents and Sewage Treatment Plant Foaming. June, Pp. 96-97.

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Natural Reduction of Paper Mill Color in Streams. By *M. A. Churchill*, Pub. Health Engr., TVA. May, Pp. 661-671.

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Taking the Spray Out of Sludge Pumps. By *Russell Grinnell*, Supt. of Plant, Birmingham, Mich. May, Pp. 685-686.

Chemical Oxygen Consumed and Its Relationship to BOD. By *W. Allen Moore*, Chemist, and *C. C. Ruchhoft*, San. Engr., U.S.P.H.S. June, Pp. 705-712.

Volatile Acid Production During the Digestion of Seeded, Unseeded, and Limed Fresh Solids. By *A. Joel Kaplovsky*, Engr., State Water Pollution Com'n, Delaware. June, Pp. 713-721.

Hydraulic Behavior of Storm-Water Inlets: Flow Into Curb-Opening Inlets. By *Wen Hsiung Li*, Asst. Prof. of C.E., *Knut K. Sorteberg*, student, and *John C. Geyer*, Prof. of San. Eng., Johns Hopkins Univ. June, Pp. 722-738.

Contamination of Vegetables Grown in Polluted Soil: Bacterial Decontamination. By *Willem Rudolfs, Lloyd L. Falk* and *Robert A. Ragotzkie*, N. J. Exp. Sta. June, Pp. 739-751.

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The Surveyor (England)

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Canton's Improved Garbage Collection System. By *A. E. Ransom*, Supt. Water & Garbage, Canton, O. June, P. 282.

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PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Precast Bridges Replace Timber Ones

The Florida State Road Dept. has replaced 12 of its timber bridges on U. S. 41 with precast concrete. Most of the timber bridges have 15 ft. span and 20 ft. width on concrete substructures. The old substructures are used, and the width increased to 24 ft. Six precast units 10″ deep and 15 ft. long comprise a span; the two outer units 3′9″ wide, with 12″ integral curb, and the other four 3′5″ wide. Half of a bridge is replaced at a time while traffic uses the other half. The timber deck and stringers are removed from half the width of the bridge and replaced with precast slabs spaced 10″ apart, the space being then filled with high-early-strength concrete. The bridge is opened to traffic 24 hrs. later. The precast units are made in the maintenance yard; a superintendent, foreman, carpenter and 7 laborers casting the six units for a span in a day. Ring bolts are cast in each slab for handling it, and after being cured the slabs are loaded on trucks and unloaded at the site by means of cranes. Cost of rebuilding a 15 ft. span with precast concrete is $550; using treated timber would cost $660, and cast-in-place concrete would cost $3,000.

"Precast Bridges Save State Money;" *Engineering News-Record*, June 7.

Rubberized Asphalt Road in Singapore

A rubberized asphalt road surface was laid as an experiment in Singapore in May 1950. Samples were taken from the road for analysis after 10 days, 4 months, 7 months and 12 months of use. From these analyses it was concluded that:

(1) Mixtures prepared by adding the rubber powder direct to the hot bitumen and hot aggregate respectively are still deficient in stability.

(2) Mixtures prepared by heating the rubber powder with the bitumen for 3 hours at 330 deg. F. before it was added to the aggregate acquired satisfactory stability under traffic.

(3) Mixtures containing rubber in the form of latex continue to be satisfactory.

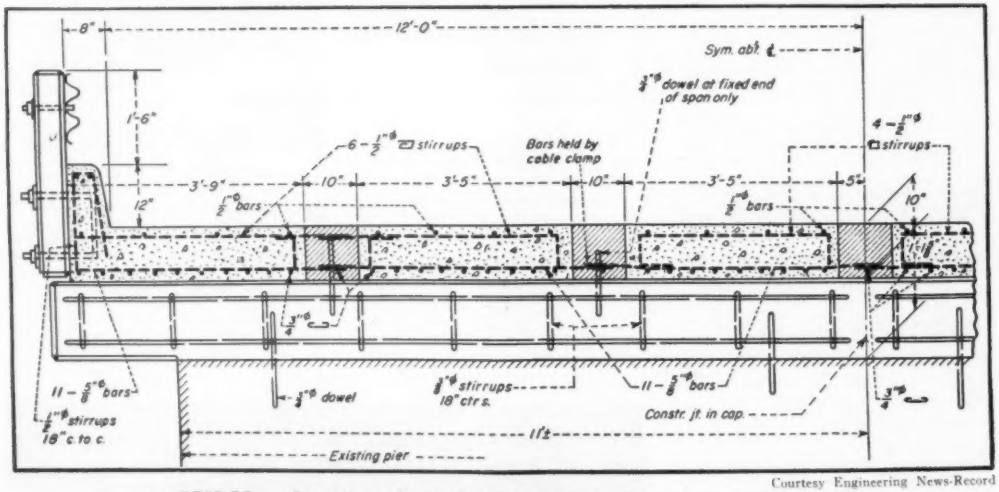
(4) The rubberized asphalt mixtures present a good non-skid surface.

It is intended to take up road samples for similar tests every year from now on.

"Singapore Experimental Rubberized Asphalt Road Surfacing;" *The Surveyor*, May 19.

Rapid Pavement Construction in Pennsylvania

In less than 9 months in 1950, V. N. Holderman & Sons completed 800,000 cu. yd. of excavation, 5 small structures, a large multiple-arch bridge, and 7.5 miles of 3-lane and 0.7 mile of 4-lane reinforced concrete pavement 9″ thick in 11-ft. lanes, on a 6″ subgrade blanket of gravel. The contractor attributes



Courtesy Engineering News-Record

● ***BRIDGE roadway is made up of six precast concrete units on existing piers.***

this success to "a combination of good men, good equipment, sound planning and development, and encouragement of a hard hitting attitude among the men."

"How 8-Mile Multi-lane Project Was Graded and Paved in a Single Year;" *Roads and Streets*, May.

Weed Control on California Highways

To limit fire hazard in connection with weed control, soil sterilization is proving successful on California highways. The liquid used consists of 25% sodium chlorate and 75% borax. District VIII has used 30 tons each season since 1949. It is assumed that two successive seasonal treatments would sufficiently sterilize the soil so that only spot treatment would be required the third year. The material is packaged in paper bags holding 100 lb. The equipment consists of a 2,000-gal. tank truck, with an internal agitator and a 1" pump. As water flows into the tank the blended chemicals are added and the agitator operated. The strongest practicable solution is 2600 lb. of chemicals in the 2,000-gal. tank. A 4 ft. spray bar is so mounted on the right hand side that it can be moved in or out or up and down. It contains 8 spray tips. In general, the solution is applied at the rate of 1/6 gal. per sq. yd. of surface. The average cost of material, labor, equipment rental, operation and supervision was approximately $75 per mile of 6-ft. width of treatment.

Harold M. Barnes—"Weed Control;" *California Highways and Public Works*, March-April.

Volume Changes in Sand-Gravel Concrete

Abnormal expansion, as evidenced by map-cracking, has been observed in concrete pavements built with sand-gravel aggregate in some midwestern states, particularly Kansas and Nebraska. In an effort to learn the reasons and remedies, the Bureau of Public Roads has conducted a series of laboratory tests, using aggregates from the Platte river in Nebraska, from Chicago, Ill., and from Long Island, N. Y.; and four different cements, two of type I and two of type II. Each aggregate was used in three different gradations in preparing concrete test specimens, which were subjected to various types of laboratory weathering cycles which involved alternate wetting and drying and heating and cooling. These produced length changes that correlated with similar concrete in the field, and which were much greater in specimens containing only Platte river aggregate than in those made with the other two. The magnitude of the expansion varied greatly with the four cements, but no chemical or other reason for this was determined. Adding crushed limestone with a maximum size of 1½" to the Platte river sand-gravel in the proportion of about 50% by weight of the total aggregate eliminated the abnormal expansion with all four of the cements; no adequate explanation of why is known.

F. H. Jackson and A. G. Timms—"Volume Change in Sand-Gravel Concrete;" *Public Roads*, June.

Anti-Skidding Roads in Virginia

The Virginia Dept. of Highways constructs three types of bituminous surfaces—hot plant mix, cold mixed in place, and seals and straight treatments. Most skidding trouble occurs with the two latter, presumably because of the difficulty of

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obtaining just the proper proportion of bitumen. Even with the hot plant mix, which is considered most satisfactory for treatment ¾" or more thick, the percentage of asphalt is varied with the different sands used, generally on the basis of surface area. The penetration also is varied with the type and amount of traffic to be carried. Seals and straight treatments account for 90% of the slippery bituminous pavements. For skidproofing slick pavements, Virginia uses four methods: 1—Rock asphalt spread at 5 to 8 lb. per sq. yd.; 2—Hot precoated sand spread at 5 to 8 lb. per sq. yd; 3—Cutback covered with 16 to 18 lb. of slag of ½" max. size; 4—The same as 3 but using RT-5 instead of cutback. The first two are rolled with pneumatic-tire rollers, the latter two with steel-wheel rollers.

H. H. Harris—"Improving Anti-Skid-Properties of Bituminous Surfaces;" *Better Roads*, May.

Clearing and Grubbing

There is a clear need for greater uniformity in specifications governing clearing and grubbing work. A committee of A.R.B.A., from data submitted by 39 state highway departments, found that they differed in the handling of this work in all respects but one—they all agreed that it is more economical to include clearing and grubbing in a construction contract than to handle it with department forces. Most states pay for this work on an acreage basis, two use the lineal foot of road. One included removing brush and trees under 6" in "earth work"; trees 6" to 15", and those above 15", are paid for as separate units. Provisions for disposal of slash and stumps vary in different states. Some consider clearing and grubbing as two separate items.

"Standardizing on Clearing and Grubbing;" *Better Roads*, May.

Mechanizing Roadside Work

The author describes briefly machines useful in landscape development and roadside construction. They include discing unit, cultivator, weeder harrow, power sod cutter, spike-tooth harrow, land roller-packer, 3-ft. wide pulverizer, seed and fertilizer drill, lime and fertilizer spreader, straw blower, pulverizer and seeder, mulching tiller, power brush mower, knapsack spraying equipment, and mechanical leaf loader.

Wilbur J. Garmhausen—"Suggestions for Mechanizing Your Roadside Work;" *Roads and Streets*, May.

Asphalt Undersealing Of Concrete in Missouri

The Missouri State Highway Dept. contracted in 1950 for delivery of 1,460,000 gal. of roofing asphalt of 35-45 penetration, to be applied at 400° to 425° F for undersealing concrete pavements. The contractor was required to be in readiness to deliver this at the time and in the quantities specified, and pump it into holes previously prepared by state crews, which clean the pavement afterward. Payment is made on a basis of gallons measured at 60° F, and varying the price with the distance from the contractor's base points.

"1,500,000 Gallons of Hot Undersealing Asphalt F.O.B. Nozzle;" *Roads and Streets*, May.

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Nebraska Seeks More Durable Concrete. By *Wm. H. Palmer*, Nebraska Dept. of Roads. May 24, Pp. 28-29.
Continuous Girder Bridges Made Less Costly. May 31, Pp. 36-37.
Precast Bridges Save State Money (Florida). June 7, Pp. 40-41.

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The Gasoline Tax in Relation to Automobile Operation and Highway Costs. By *E. M. Cope*, Chief Statistics Sect., and *L. L. Liston*, Transport Economist, B.P.R. June, Pp. 157-161.
Volume Changes in Sand-Gravel Concrete. By *F. H. Jackson*, Prin. Engr. of Tests, and *A. G. Timms*, Sr. Materials Engr., B.P.R. June, Pp. 162-172.

Public Works

Uniform House Numbering and Street Naming System. By *Daniel S. Marsin*, Tenn. State Planning Com'n. June, Pp. 53-54, 72.
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Roads and Road Construction (England)

A Rapid Method of Analysis for Bituminous Road Materials. By *A. R. Lee, C. M. Gough* and *E. H. Green*, Road Research Lab. May, Pp. 128-130.
The Use of Rolled Concrete in Carriageway Foundations. By *A. G. Dann*, May, Pp. 136-137.
The Design of Kerbs and Channels (Curbs and Gutters) to Improve the Security and Increase the Capacity of Roads. By *Ricardo C. Humbert*, town planning consultant, Paris, May, Pp. 143-146.

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County Makes Resourceful Use of War Surplus Bridges. By *James G. Cooney*, Clinton Co., Ill., Supt. of H'ways. May, Pp. 47-50.
Mechanizing Your Roadside Work. By *Wilbur J. Garmhausen*, Chf. Landscape Engr., Ohio H'way Dept. May, Pp. 52-56.
Patching Mix Deserves Modern Plant Control. May, Pp. 72-73.
Sand Asphalt Mixed-in-Place Highway Construction. By *R. G. Fallon*, Am. Bitumuls Co. May, Pp. 78-80.
1,500,000 Gallons of Hot Undersealing Asphalt F.O.B. Nozzle. May, Pp. 67-68.

Sewage Treatment Results at Daytona Beach

RESULTS of operation of the sewage treatment plant at Daytona Beach, Fla., are now available for the 12-month period from May, 1950, through April, 1951. These results are shown in Table 1, herewith. The

TABLE I—RESULTS OF TREATMENT

Month	Av. Flow	Raw BOD	Eff. BOD	Removal
May, 1950	2.8 MGD	224 ppm	61 ppm	72.8%
June	2.9 "	179 "	69 "	64.2 "
July	3.6 "	177 "	70 "	60.4 "
August	3.1 "	204 "	65 "	68.6 "
September	3.2 "	147 "	55 "	62.5 "
October	5.2 "	154 "	51 "	66.9 "
November	4.7 "	157 "	57 "	63.6 "
December	3.9 "	176 "	75 "	57.4 "
January, 1951	3.9 "	165 "	105 "	36.4 "
February	4.2 "	229 "	98 "	57.1 "
March	2.8 "	283 "	77 "	72.8 "
April	2.5 "	295 "	84 "	71.5 "
Average	3.6 "	199 "	72 "	65.3 "

Daytona Beach plant, which employs the so-called Daytona Beach Process, was described in PUBLIC WORKS for April, 1949. Waste lime sludge from the water treatment plant is utilized as a coagulating agent and the undigested sewage sludge is dewatered on vacuum filters.

John J. Hamilton acted as Chemist and Plant Operator from the latter part of May, 1950, but has now returned to the American Water Works Co. The data shown in Table I are as reported by Mr. Hamilton. In this table, the averages for January, 1951, are excluded. The water treatment plant was being reconstructed during that month and no lime sludge was discharged, so that the sewage treatment plant acted merely as a primary treatment plant. Comparison of results for January with those for other months indicates the importance of the application of the water plant waste sludge in the treatment process.

The moisture content of the vacuum filter sludge cake has varied from a low of 41.5% to a high of 52.0% and, for the year, averaged 47.2%. Dewatering is accomplished on Eimco filters and the sludge is disposed of on land fill. The plant was designed by Russell & Axon, consulting engineers, and the above data were furnished by Joe Williamson, Jr.

Special Engines Expedite Moving Rock Crusher

Although powered by three 6-cylinder diesel engines, a portable rock crusher operated by Aggregates Producers of Charlotte, N. C., can be moved without removing and remounting the engines. This results in a saving of two days time and $300 per move. Powered by GM diesels, this unit, which was made by Pioneer, turns out 1600 to 1800 tons per day of 1½-in. to 3-in. aggregate. Maximum production has been 2194 tons.

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PUBLIC WORKS DIGESTS

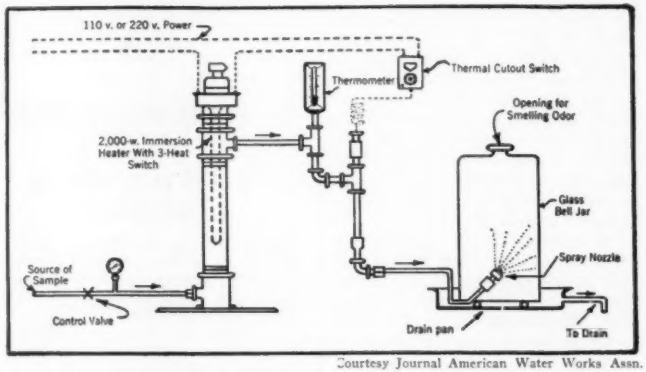
THE WATER WORKS DIGEST

Continuous Testing of Threshold Odors

The author describes an apparatus for continuous monitoring of odors and testing for threshold odor, developed by him at the Chicago South Dist. Filtration plant. For obtaining a qualitative indication of the character of the odor and a fair indication of its intensity, the water is passed continuously through an electric heater, where it is heated to approximately 120° to 140° F, and then sprayed into a glass jar, where the odor can be sniffed through an opening in the top, into which a standard osmoscopic nosepiece can be inserted. The optimum temperature appears to be between 120° and 130° F.

The standard method of threshold door testing requires the preparation of a number of samples diluted with different proportions of odor-free water, heating these to 140° F, and determining which is the most dilute portion giving off a perceptible odor. Instead of preparing a number of test portions, the author devised an odor tester which eliminates this. The water to be tested and the odor-free water both flow continuously and jointly into a common pipe, which delivers the mixture into the odor monitor; the proportion of odor-free water to test water being gradually changed by means of rotameter flowmeters until the odor is barely perceptible, and the meters then read. Each rotameter is equipped with a ⅛" needle valve to adjust the flow rate, which may vary from 1 ml. to 1120 ml. per minute.

H. H. Gerstein—"A Continuous Odor Monitor and Threshold Tester;" *Journal, American Water Works Ass'n*, May.



Courtesy Journal American Water Works Assn.

● ***CONTINUOUS odor monitor helps in water treatment.***

Photographing Defects in Wells

The author describes a camera which can be lowered to any depth in a well and can expose 800 double sets of pictures through two lenses before hoisting for reloading, permitting a detailed study of the entire lining of the well, to locate and determine the nature of any fracture, distortion or other cause of trouble. The camera and the source of light are operated electrically. The camera, with its electric motor and stroboscopic condensers and tubes, is sealed into a heavy steel tube to withstand high hydrostatic pressures. The film used is 35 mm. The light source uses 3,000 v. flashes of power. By using a changing bag and field development kit, the film can be developed as soon as the camera has been raised to the surface. The camera has been operated in a water well to a depth of 2,000 feet.

Claude Laval, Jr.—"Photographing Water Wells;" *Journal, American Water Works Ass'n*, May.

Decontaminating Radioactive Water

Recent investigations into the decontaminating of radioactive liquids at Oak Ridge National Laboratory have led to the development of a compact decontamination unit which can be adapted to purify emergency drinking water supplies from a highly radioactive water, giving a product containing 0.01 of the maximum concentration suggested as acceptable for emergency use during a 7-10-day period. The most effective treatment consists of passing the water through the following materials, arranged in series: steel wool, burnt clay, activated carbon, and a mixture of anion and cation exchange resins.

R. A. Lauderdale and A. H. Emmons—"A Method for Decontaminating Small Volumes of Radioactive Water;" *Journal, American Water Works Ass'n.*, May.

Electrically Operated Valves in Distribution System

The water distribution system at the Naval Ammunition Depot at Crane, Ind. is of the semi-loop type which can be divided into seven isolated zones and contains five 100,000-gal. elevated tanks. A break or other large leak would cause an unusual draw-down in the tanks which would show up on electrical recording devices at the treatment plant. Locating the leak was then a process of elimination by isolating one section after another. This required manual closing of control valves and

a large force of men in the field, and was complicated by lack of adequate communication between these crews and the central plant. Locating the leak has required as long as 18 hours. The process has been speeded up at least eightfold by centralizing valve control in the water plant by installing a Westinghouse Unicode Supervisory Control System, by which 20 electrically controlled valves can be operated from a master control panel. This system includes 18 miles of control circuit. The total cost was $36,000. The isolating of sections is effected from the control panel, and as each is isolated it can be determined in 10 or 15 minutes whether it is the one in which the break is located.

William W. Gentry—"Electrically Operated Valves Control Water Distribution;" *Public Works*, June.

Mobile Radio Communication

The advantages of this over other mobile means of communication are: There is no limit to the number of calls that can be made; it needs no operator through whom the calls must be made; there is no delay in long distance communication; and a means of communication is readily available at any time of the day or night. The installation of a 40-w. land station costs about $1,200, and the average price of a 30-w. mobile unit, installed, is about $500-$800. (Prices as of October 1950 in California.) Cost to San Jose, Calif., water works during two years for maintenance averaged $1.20 a month per unit for parts; and maintenance of all radio equipment, under contract, $15 per month per land station and $7 per mobile unit. By its use, four servicemen are saved three trips a day into the office for orders, or 6 to 8 man-hours per day, plus corresponding saving in truck mileage. The saving resulting from dispatching a crew to a bad leak as soon as it is reported cannot be determined easily.

M. J. Shelton and N. J. Kendall—"Mobile Radio Communication in California;" *Journal, American Water Works Ass'n.*, May.

New Water Supply For Alexandria, Va.

An entirely new water supply system has been promoted, planned, and constructed to serve Alexandria, Va., and the surrounding area. The previous source of supply had become inadequate in quantity for the increasing population. The new supply, designed for 4 mgd, is taken from Occaquan Creek, about 20 miles south of Alexandria, where the water company purchased the rights and property of a power development which had been projected 50 years ago but never carried through. During the past year and one-half the water company has completed a dam and intake 1800 ft. up stream from tidewater; a conduit to a pumping station, carrying water for both domestic use and power generation; a pumping station, transmission main to a purification plant and high service pumping station, and one from this plant to Alexandria. The dam will impound about 55 mg, and the old power company's dam upstream makes 1.5 to 2.0 billion gals available. The conduit from the intake contains two 4 x 4 ft. compartments for carrying water for power generation and a 2 x 4 ft. compartment for the water supply, which first passes through a fine-mesh traveling screen. Two of the 3 raw-water pumps can be driven by hydraulic turbines, which also drive an electric generator, which furnishes power for driving two high-service pumps and the third raw-water

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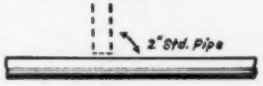
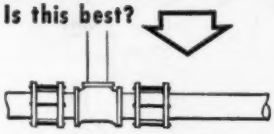
what the simplest answer is to this everyday problem

Running a lateral connection to an existing underground pipe (same size) line is often a lot simpler to do on the drafting board than actually accomplishing the job in a 2-foot trench!

PROBLEM: *Make this connection between an existing 2" line and a new 2" lateral.*

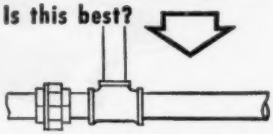


Is this best?



Would you cut the line, remove a section and use 2 flex. couplings, a screwed tee and 2 T.O.E. nipples?

Is this best?



Would you cut the line, remove a section, thread both ends of the existing line; and use a screwed tee, a nipple and a union?

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Here we haven't so much fussing around to do in the trench; so you'd just cut the line, remove a section and put in a

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2. Uses fewer fittings than other usable methods; just how much is really dispensed with can be gained from reading the two other possible solutions to this problem shown above.
3. Saves a very sizeable amount of labor on every such installation.

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pump. The raw water is pumped approximately 2500 ft. to the purification plant, which is on a hill 245 ft. above tidewater.

The treatment process is the common one, using alum, lime, carbon and chlorine, but the construction is unusual. There are four units, each with complete facilities for mixing, flocculation, settling and filtration. Each unit is in a round steel tank 84 ft. in diameter and 15 ft. deep, and the different processes are accomplished in annular compartments. In the center is a circular mixing and flocculating compartment, surrounded by an annular settling compartment; and this in turn is surrounded by an annular filter of sand on a carborundum plate bottom. Below the filter is an annular filtered water compartment 4 ft. deep. Filter washing is automatic, and this and all the filter operations can be controlled from a control board located in a central building. Here are head-loss and flow-rate recorders and the customary gauges. A continuous chlorine residual recorder is located in the chlorination room.

When operating, there is normally about 8 ft. depth of water on the filters, and they are refilled to this depth after washing before filtering is renewed. This fact and the passing of the settled water over a long weir directly to the filter minimizes the breaking up of the floc. Also there is no negative head in the filter sand even with a filter loss of 8 ft., which is reached after a filter run of 40 to 65 hr. It was estimated that a conventional design of purification plant to give the same treatment would have cost twice as much, or more. This plant has been in continuous operation since Dec. 1, 1950.

E. H. Aldrich—"A New Water Supply for the Alexandria Water Company;" *Journal, American Water Works Ass'n.*, May.

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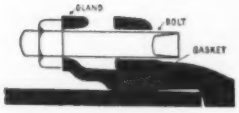

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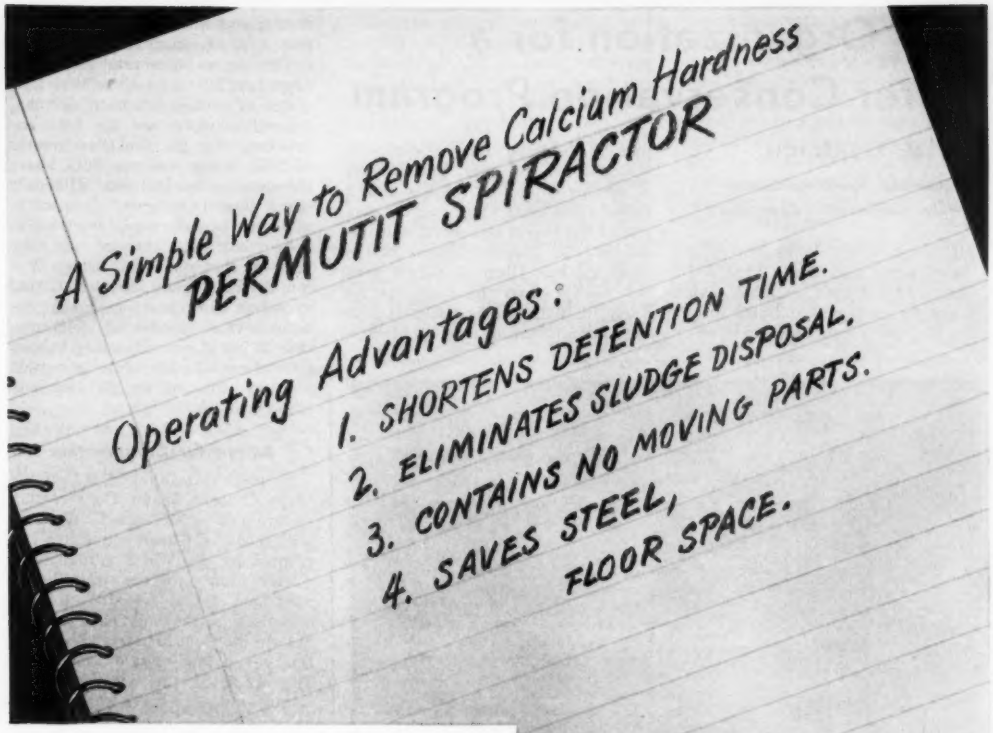
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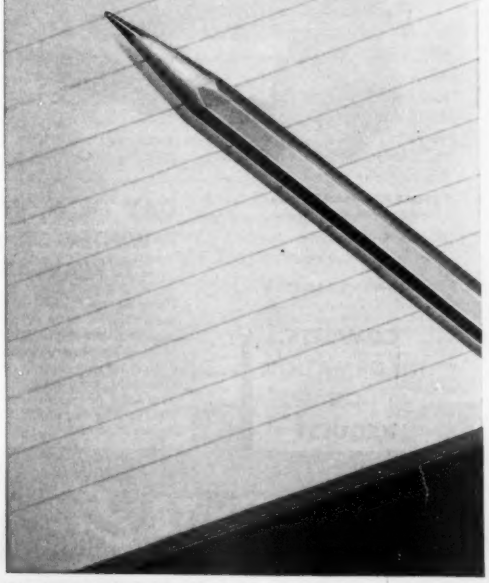

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Organization for a Water Conservation Program

M. J. SHELTON,

Chairman, San Diego County Water Conservation Committee

THE worst drouth in its history is now facing San Diego City and County. This drouth, coupled with the greatly increased military program and the recent industrial expansion, bringing thousands of new residents to the area, has created a serious situation. Last winter's runoff from local water sources was one of the lowest on record, and the delivery of Colorado River water from the San Diego aqueduct does not nearly equal the consumption. Early in 1951, studies disclosed that the total amount of water in storage throughout the county amounted to only 17% of capacity.

The last above-normal runoff occurred in 1944 and since that time water in storage has been decreasing, while water use has been increasing. For the first five months of 1951, water use was 30% above the same period last year. If such a trend should continue, all reserves will soon be exhausted. Our studies show that, with normal use, the ten agencies of the San Diego Water Authority will require 118,000 acre-feet this year, whereas the aqueduct is capable of delivering only 73,000 af, even if pushed beyond normal capacity by careful operation and by chlorination to eliminate slime growths.

Action for Conservation

To meet this situation, a County-Wide Citizens Water Conservation Program was organized. Working with a special 6-man committee appointed by the Water Authority, a conservation program was developed and action initiated. In this organization, the only paid personnel are the Coordinator and his secretary; all others are volunteers. The scope of the organization is county-wide and takes in all water-using agencies. Local water conservation committees have been formed with the purpose of contacting every water consumer in the area in an effort to reduce water usage and loss. Contacts with consumers are made through newspapers; by talks to service, PTA and women's clubs; through the schools; and by means of literature distributed with monthly water bills.

The necessary initial costs for this program were covered by a special appropriation set up by the water authority. A finance subcommittee of the Water Conservation Committee is now planning a general assessment program to raise enough money to cover the cost of the program to the end of the year.

The Conservation Program

Cooperation is the keynote of all publicity. It is felt that with the cooperation of all consumers and the elimination of water waste, sufficient savings will be accomplished so that there will be enough water for 1952 use under the same type of conservation program. Full support has been given by the press, radio, television, the Plumbing Contractors Association and many others. The San Diego evening paper

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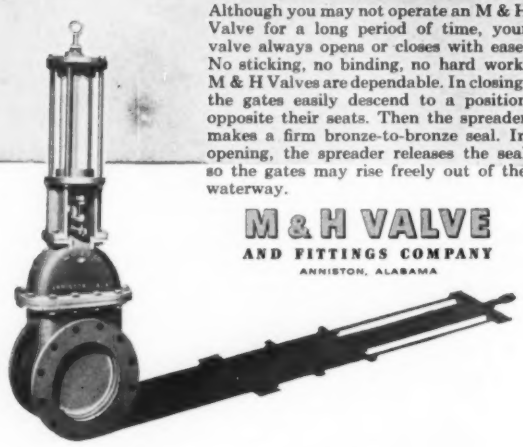

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has run a series of photographs with explanatory stories showing the right and the wrong way to do a job while conserving water. There have been daily articles, generally front-page, in all newspapers. Various program sponsors have carried our story over television and radio. The Plumbing Contractors Association is currently carrying a series of articles showing consumers how to repair leaky plumbing fixtures.

Early in the program a "Target Day" was established. The purpose of this was to establish a target or goal for a reduction from a "normal" consumption for the city of San Diego of 51,000,000 gpd to 34,000,000 gpd. "Target Day" resulted in a reduction to 38,550,000 gals., nearly reaching the goal. Another special day is now planned to be called "Fix It Day." This will be followed by another "Target Day" and later there will be other special days. Daily publicity keeps before the consumers the results of their cooperation by comparing the water consumption with the average or with the same day of the preceding year. One agency showed a 22% reduction for a 30-day period though it had 12% more consumers than the year before.

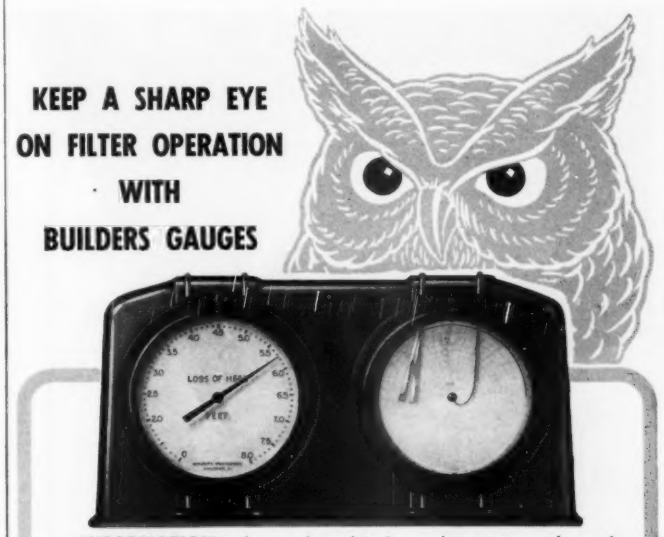
The goal of this campaign is not to exceed last year's consumption in spite of the tremendous increase in population, military activity and industrial use. This will require a cut in per capita water use of nearly one-third.

Long-Term Correction

What is San Diego doing to correct the condition which causes such a shortage? The San Diego Water Authority, whose membership consists of ten water agencies representing about 80% of the water used in the county has, for the past two years, been carrying on the preliminary steps toward the construction of the "second barrel" of the San Diego aqueduct. A bill was introduced into Congress late last year; the Navy has completed an engineering report; and the Bureau of Reclamation has just completed an engineering and feasibility report which was requested by the Authority more than a year ago. Both of these reports are now in the Budget Bureau which must pass on the proposed project before Congressional Committees can act.

The cost of this project, estimated at about $15,000,000, will be repayable over a 40-year period by the San Diego County Water Authority. When the original construction was carried on, all tunnels were constructed to full capacity, whereas the aqueduct pipe line was constructed to 50% capacity. Title of the right-of-way vests in the Federal Government which makes it necessary that the proposed construction be performed under jurisdiction of a Federal agency.

The Water Authority has proposed to the Metropolitan Water District and the Navy that actual construction plans and specifications be prepared by the engineering staff of the Metropolitan Water District immediately, with Navy personnel assisting in an advisory capacity to assure that such work is in accordance with their standards and to eliminate a later engineering review which would be time-consuming. If done, this could well save four to six months time and permit construction work to be started and completed that much sooner. At best, it is anticipated that the second barrel of the aqueduct will not be able to deliver water until the season of 1953-54. Meanwhile it is necessary that the Water Conservation Program make the best



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use of local storage until this increased capacity is available.

A close check on the progress of the program is being maintained and should it not appear that the cooperative program is accomplishing the desired effect, it will be necessary to adopt rationing, a policy that it is hoped will not be necessary. However, sufficient legislation now exists on the State level, and in the form of local ordinances as well, so that such a rationing program could be set in motion without the necessity of passing any new laws.

Details of Steel Reservoir Construction

THE water distribution reservoir system of Long Beach, Calif., is unique in that it consists of multiple steel tanks, located at elevated sites, each tank containing slightly more than 3,300,000 gallons. Local geological conditions warrant the design of steel tanks for earthquake resistance and ground subsidence.

The reservoir consists of 12 steel tanks, each 132 feet in diameter and 34 feet 9 inches high. Five separate courses of welded steel shell plates are used in construction. The thickness of the top course is ¼-inch and that of the lower course ⅞-inch. Intermediate shell plates are graduated by even decreases in thickness between the top and bottom plates. The tanks are covered with a wooden roof on steel girders supported by columns of 8-inch pipe.

An unusual feature of the tanks is the reinforcement. This is obtained by means of twenty ⅞-inch diameter tie rods with turnbuckles attached extending radially from the central column to reinforce the upper rim of the tank. This is twice the number of tie rods used on the Department's Alamitos Reservoir tanks, which were erected in 1932 and which successfully withstood the earthquake of 1933. At that time a similar tank in a nearby city failed in the 1933 earthquake because it was not reinforced with tie rods. Another precautionary measure is to drill twenty 24-inch diameter holes to a minimum depth of 20 feet in the subgrade under each tank and fill them with coarse sand to drain any trapped water under the tank into the more porous lower formations.

Foundation Design

The grading and development for the reservoir required excavating 64,170 cubic yards of earth. A sand mat foundation one foot thick was placed over the clay subgrade. In order to facilitate drainage of the tank, the mat was made one foot higher at the center than it is around the circumference. The shaping of the sand mat foundation to the required spherical crown was accomplished with a tractor and carryall, spiralling from the center of the tank foundation at minimum turning radius, and skimming or depositing sand in accordance with grade requirements. The result achieved was highly satisfactory and almost unbelievably precise for such a large piece of equipment.

Tank construction began by laying rectangular and sketch plates on the sand mat foundation, then spacing, tacking and welding them. Next, the first course of shell plates was assembled, erected, and their vertical seams joined by double-welded vertical and horizontal butt joints. Flush sides of the shell plates are on the inside.

A special item of interest was the requirement that the assembled

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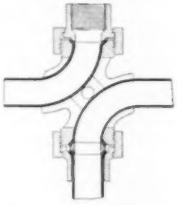

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first shell ring and bottom be jacked up on cribbing for completion of the bottom watertight seal weld and the application of coal-tar enamel, an undercoating process used at the Alamitos Reservoir in 1936 and found by recent inspections to be still in excellent condition. The bottom of the tank was first cleaned with a coal-tar solvent and then sandblasted. Next, the coal-tar priming solution was applied and permitted to dry at least 24 hours, but not longer than 96 hours, after which the coal-tar enamel was applied. The coal-tar enamel was heated in kettles to 450° F, poured into 2½-gallon electrically heated buckets, and applied with Tampico-type daubers. 'Holidays' in the enamel coating were detected with an electric flaw detector.

While the tub consisting of the bottom and first shell ring was supported on the cribbing, the 24-inch inlet and outlet elbows were welded in place in the bottom plates and given a protective coating. The tub was then subjected to a vacuum seam test for leakage. When this test was approved, the grade and crown of the sand mat was re-established, the cribbing removed under the center portion of the tank, and the sand impregnated with road oil at 350° F applied from pressure spray nozzles. Another ring of cribbing was then removed, the sand mat crown reshaped, and road oil applied, the process being repeated again and again until the tank was completely lowered onto the sand mat.

Four additional courses of shell plates were then added to complete the tank. This operation was accomplished by welders working from scaffolding supported on triangular brackets attached to lugs welded to the tank plates.

After roof girders were in place, but before redwood sheathing was placed, the tank was tested for leakage by being filled with water. Following successful completion of the water test, the 2 x 10-inch treated Douglas fir rafter system was installed, covered with 1 x 6-inch tongue and groove redwood sheathing, and asphaltic roofing applied.

After the tank roof was completed, the inside surface of the shell plates was sandblasted and coal-tar enamel applied, the bottom inside surface being coated to a thickness of ⅛-inch and the sides to a thickness of 3/32-inch. The exterior surface was given two coats of red lead primer and a finish coat of aluminum paint.

Mobile Highway Testing Laboratory

For testing and evaluating materials for highway and airfield construction, a mobile testing laboratory, housed in a 28-ft. trailer, has been developed by the Engineering Research & Development Laboratories, Ft. Belvoir, Va. The laboratory contains a combination test machine which can run California bearing ratio and Marshall stability tests; a drying oven; compaction equipment; constant temperature hot water bath; and a generator. Built-in jacks level the laboratory, which can be towed at convoy speeds. Information in more detail is available from Room 2C-765, Pentagon, Washington 25, D. C.

Ocracoke Roads

(*Continued from page* 43)

ways formed the favorite diet of these ponies, but with the coming of the roads they are now regaled by the oats growing on the road shoulders.

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pensive for wide emulation; the Highway Commission spent some $50,000 on them. Yet they mitigate the harshness of life at Ocracoke and provide a real service to the islanders in connection with North Carolina's recent $200,000,000 road bond issue. The "expensive" roads illustrate the kind of ingenuity by which road builders can end the isolation of such relatively inaccessible spots.

Nor have the roads, as some people feared, "spoiled" the natural beauty of Ocracoke. One of the islanders writes: "Ocracoke's 'Main Street' remains untouched by modern cement; it is a beautiful narrow lane of sand, winding under age-old water oaks through groves of myrtle and youpon, bordered by quaint white fences that yard-in some of the old homes of the island, first settled between 1710 and 1715 by fishermen and pilots.

"And for those who fear modernization, let them be reminded that there still exists 16 long miles of sand along the Atlantic Ocean from Hatteras Inlet to Ocracoke Inlet—uninhabited except by the wild ponies and the sea gulls and an occasional sports-fisherman."

Making Rain

(*Continued from page 38*)

agency set up in a state, then the public will never be able to go to a source for an answer it will rely on unless the Federal government takes over the job.

At the present time the State of Colorado has a committee working on a proposal to regulate artificial weather modification. This was submitted to the legislature in the form of a bill and was passed by both houses in March. The spirit of the bill is to encourage experimentation and development in every reasonable way. A very minimum of regulation is spelled out but a commission is proposed which will be able, as the need arises, to adopt the necessary regulations to protect the public interest. The commission recommended would be composed of one representative, appointed by the Governor, from each of the four Congressional districts in the State, and the State Engineer. The commission, among other things, is empowered to hire an individual or organization to evaluate scientifically operations carried out in Colorado. The Commissioner of Agriculture actually handles the admin-

istration of the Act on recommendations of the commission. The commission will recommend licenses and hear cases involving license revocation or charges against an operator. It will also have power to require an operator to cease activities in any area where it could be shown excess moisture would be against the public interest at a particular time.

The committee that worked out the proposal consisted of varied interests within the state. It invited in other parties who might offer criticisms or recommendations to make a better bill. The principal opposition appeared to be from groups already contracting for extra rain or snow and who resented governmental interference in the way they spend their money. They did not seem to realize that the entire public is concerned deeply in these activities and that the intent of such a bill is not to hamper experimentation and development but to provide reasonable safeguards of the public interest. If the opponents are paying for something they would have gotten anyway, they will probably be glad to learn about it one of these days. The bill can not conceivably keep any group from getting a legitimate rain-increasing job done and spending as much for it as they see fit.

A bill has been introduced in the Federal Senate, known as the Weather Control Act of 1951, by Senator Anderson of New Mexico, that gives the Federal Government pretty complete control over anything done along this line. It also sets up a commission under the Secretary of Commerce with very great powers for rigid control of the conduct of experiments and operations. It further would protect any contractor (operator) from damage suits growing out of his activities. The Government would stand these if proven.

This commission would be empowered to carry out, or have carried out, research in all aspects of weather control including processes, devices, and materials, as well as the utilization of weather control in agriculture, industry, commerce, and military operations. It would also have the power to issue and revoke licenses. Not the least of the contemplated powers of such a commission would be to fix fees, rates, or charges in weather modification contracts. It could issue injunctions in any case where it felt the general welfare would thus be served. It

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could also require reports of all activities and methods of operators, and inspect the activities at any time. In other words, this proposed commission would have practically absolute authority in the control of any weather modification or weather research activities carried on in the United States.

It is understood that several states in addition to Colorado are considering legislation at this time to regulate in one way or another the operations of those engaged in artificial nucleation. Arizona, California, and Wyoming are three known to have under consideration such bills. At a meeting of the Western Interstate Committee on Agriculture held in Santa Fe, New Mexico, last October, the following resolution was passed regarding artificial nucleation:

"Since the business of artificial nucleation of clouds to create rainfall has relatively recent beginning and has not progressed to a status where regulation is indicated, although some preliminary supervision by a proper state agency would appear desirable, your committee recommends that:

(a) Research and development work in artificial rainmaking be encouraged;

(b) Legislation be adopted, if necessary, to provide for the registration with a proper state agency of (a) persons or organizations engaged in the business of operating artificial nucleation equipment with provision for information on areas of operation, and (b) of persons or organizations selling equipment and supplies for artificial nucleation or possessing equipment and supplies used in connection therewith."

It is believed by many people that the first statement in the resolution is not strong enough. Apparently some Congressmen feel that *strong* regulation is indicated, and a number of others in positions to know, feel definitely that a reasonable minimum of regulation is needed. While unduly restrictive legislation would undoubtedly hamper and discourage free experiment and development, that being proposed in Colorado would not. It is so flexible that it will enable rules and regulations to be developed as the need arises. It does give the reasonable minimum protection, however, to which the general public is entitled at this time.

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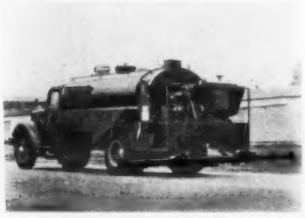

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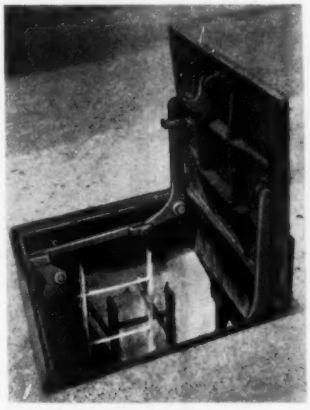

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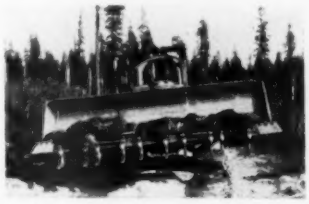

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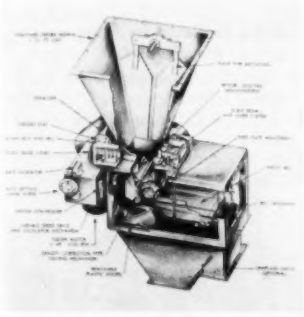

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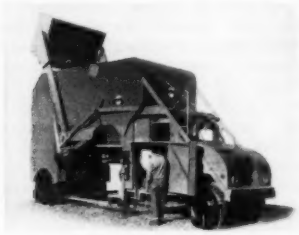

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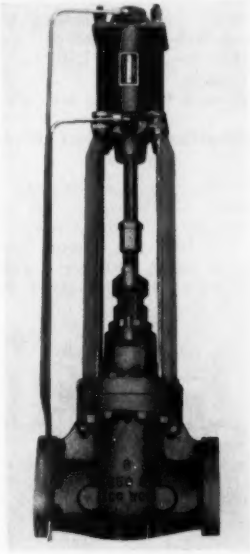

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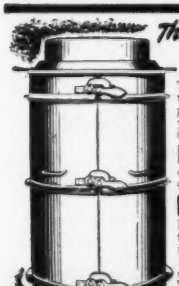

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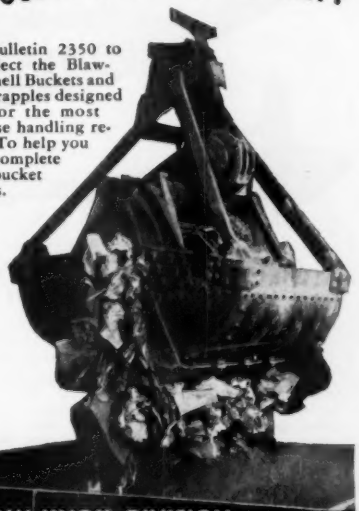

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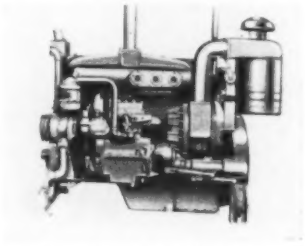
Two new diesel engines are announced by Caterpillar for mid-year production. Both are 6-cylinder. The D337 has a rated horsepower of 180 at 1600 rpm; the D326 is 125 hp at the same speed. Fuel pumps adjacent to the cylinders they serve; oil-cooled pistons; and filtration elements to handle the full flow of oil are features of these new engines. A 25 hp vertical gasoline starting engine is used. More information from Caterpillar Tractor Co., Peoria, Ill., or by using the coupon.



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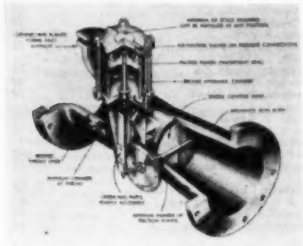

Builders' powered control.

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PERSONAL NEWS

Lloyd K. Clark, who recently returned from a tour of duty at Ft. Churchill, Canada, has been appointed sanitary engineering consultant to the Dep't. of Health of Alaska. This is sort of out of the refrigerator and into the deep freeze; or having been at Churchill, your editor might reverse the order to read out of the deep freeze and into the refrigerator. That pre-war toughening up in North Dakota's winters seems to be standing Lloyd in good stead now.

Richard Hazen, who was in the Navy during the war, and has since been one of the partners of Malcolm Pirnie Engineers, has now opened his own office at 110 West 42nd St., New York, and will handle municipal and industrial water supply and treatment and sewage and waste disposal.

NOTICE TO BIDDERS

Sealed bids will be received until 9:00 a.m. EST July 17 A. D., 1951, in the office of City Auditor and Clerk for Well Pumping Stations, Wells, Pumps, and Appurtenances.

Bidding blanks may be obtained from the office of the Engineer. Plans and specifications are on file in the office of the Engineer.

A deposit of $25.00 for plans and specifications, and of $15.00 each for additional copies of plans and specifications, will be required. All deposits for plans and specifications will be refunded upon their return in good condition within ten (10) days of the opening of bids.

A certified check for 5% of the total amount of the bid, made payable to

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shall accompany each proposal as evidence of good faith and responsibility of the bidder. This check shall be retained by the payee as liquidated damages should the bidder fail or refuse to enter into a contract with the payee for the execution of the work embraced in the proposal, in the event the proposal of the bidder is accepted.

The Owner reserves the right to reject any or all bids.

R. K. Lowry
City Manager

NOTICE TO BIDDERS

Sealed bids will be received until 9:00 a.m. EST July 17 A. D., 1951, in the office of City Auditor and Clerk for: Raw Water Mains & Secondary Distribution.

Bidding blanks may be obtained from the office of the Engineer. Plans and specifications are on file in the office of the Engineer.

A deposit of $25.00 for plans and specifications, and of $15.00 each for additional copies of plans and specifications, will be required. All deposits for plans and specifications will be refunded upon their return in good condition within ten (10) days of the opening of bids.

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The Owner reserves the right to reject any or all bids.

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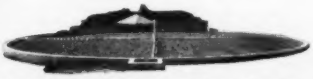

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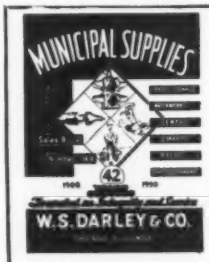

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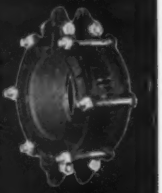

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193. In addition to specification and illustrations of roller operation, the new Buffalo-Springfield catalog features a special section to help in the selection of the right roller model for the job. Be sure you get top results from your roller selection by checking this helpful material. Use the coupon for a copy. Buffalo-Springfield Roller Co., Dept. Q-7 Springfield, Ohio.

Versatile Wheeled Tractor Handles Countless Jobs

204. A new booklet on industrial wheeled tractors recently published by The Oliver Corp. covers the complete Oliver line. Many application photos show use of tractors with matched allied equipment such as bucket loaders, maintainers, plows, mowers, brooms, etc. Get this bulletin, Form A-918, from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, Ohio.

STREETS AND HIGHWAYS

How to Select the Proper Sno-Plow for Your Truck

21. Fully illustrated 24-page catalog on Frink Sno-Plows includes valuable tables on proper plow and leveling wing selection for mounting on all size trucks. Detailed discussions cover special features which result in performance plus economy. Use coupon for copy. Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

How the Mobil-Sweeper Can Improve Street Sweeping

23. Sweeping costs can be cut with the new Mobil-Sweeper which features safe highway speeds up to 35 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

How to Beat The Weed Problem

66. Be sure to investigate weed control with selective chemical weed killers that get roots and all. Send in coupon today for bulletins on Dolge products that will rid roadsides, parks and lawns of the weed nuisance. C. B. Dolge Co., Dept. PW, Westport, Conn.

Latest Bulletins on the Hough "Payloader"

107. Carrying dirt and backfill, loading snow, grading and bulldozing are a few of the many jobs quickly handled by public works departments that use Hough "Payloaders". Several models having bucket sizes from 12 cu. ft. to 1½ cu. yds. are offered. Check them all to see which is best suited for your jobs. The Frank G. Hough Co., 709 Sunnyside Ave., Libertyville, Ill.

Helpful Bulletin Shows Roadbuilding Methods

141. Laying base or surface aggregates, free-flowing hot or cold bituminous mixtures and plant-mixed stabilized soil with the Jaeger paver type aggregate spreader are described and illustrated in Catalog SPS-1. Get data on this variety of roadbuilding methods and full specifications by checking the coupon. Jaeger Machine Co., 400 West Spring St., Columbus 16, Ohio.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept., PW, Warren, Ohio.

Black-Top Paver Offers Many Advantages

150. The flexible Adnun Black Top Paver lays any asphalt mix, hot or cold, in widths from 6 ft. to 13 ft. Careful design lowers operating cost and cuts maintenance. Attachments spread stone, cinders or slag. Get full data on this machine by checking coupon. The Foote Co., 1954 State St., Nunda, N. Y.

WATER WORKS

Data on Modern, High-Rate Water Treatment Plant

40. This handsome 28-page bulletin gives a comprehensive yet understandably written story of the development of the Accelator, and explains its principles, advantages, design considerations, operation and applications. Helpful flow diagrams and specifications. For a copy use the coupon or write Infilco Inc., Box 5033, Tucson, Ariz. Ask for Bulletin 1825.

Engineering Data on Diatomite Filters

44. Detailed information and typical plans of Sparkler diatomite filters for swimming pools of municipal water systems is available to engineers and municipal officials. These filters feature self-cleaning filter elements which cuts wash water to a minimum. Get this material now by using coupon. Sparkler Manufacturing Co., Mundelein, Ill.

Helpful Data on Hydrants

64. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Dept. P.W., Anniston, Ala.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Factors to Consider in Elevated Tank Selection

89. An interesting discussion of the factors to be considered for selection of elevated capacities and sizes, required fire flows and other useful data are included in a bulletin on elevated water storage published by Pittsburgh-Des Moines Steel Co., Neville Island P. O., Pittsburgh 25, Pa.

Painting Water Tanks For Longer Protection

94. High labor costs demand special consideration when painting elevated water tanks. This and other factors involved in proper paint selection are discussed in a bulletin issued by Jos. Dixon Crucible Co., Dept. 7 P, Jersey City 3, N. J. Helpful specifications for repainting water tanks are also included.

Tested Jointing Materials

102. "Hydrotite" is a self-caulking, self-sealing joint compound for bell and spigot pipes. For data book and sample write Hydraulic Development Corp., 50 Church St., New York, N. Y.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

How to Tap Concrete Pressure Pipe

126. The simple steps required in making a pressure tap in concrete pressure pipe are explained in a booklet issued by Lock Joint Pipe Company. Be sure you know how either large connections or small service outlets may be made economically and without sacrifice of strength. Just check the handy coupon. Lock Joint Pipe Co., Box 269, East Orange, N. J.

All About Cement-Mortar Lining of Water Mains

133. Here, in a really beautiful booklet, is practically everything you need to know about this method of lining mains in place—the needs, methods, and results that will interest you. Centrifline Corp., Dept. PW, 140 Cedar St., New York 6, N. Y.

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

Rehabilitation for Your Water System

153. Whether your water supply system requires a complete rehabilitation program including an engineering survey, hydraulic analysis, reconditioning and related construction, or merely pipe cleaning and coating, it is wise to plan your campaign without delay. Get full data now on the requirements to put your system in top condition. Write Pittsburgh Pipe Cleaner Co., 133 Dahlem St., Pittsburgh 6, Pa., or check handy coupon.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Handy Catalog Covers All Pipe Repairs

167. A complete catalog covering repair clamps, packings and gaskets of several designs to suit all needs is offered by the Smith-Blair Co. Directions for use show ease of application. Every water works needs a copy of this catalog for ready reference. Available by using coupon or writing Smith-Blair, Inc., 535 Railroad Ave., So. San Francisco, Calif.

Pipe Joint Essentials and Couplings for Every Job

168. Superior pipe joints are tight, flexible, simple, strong and economical. Dresser's handsome 34-page bulletin No. 513 shows how these essentials are met and provides layouts for curves, working pressures and a wealth of other data. Be sure to check this bulletin on the coupon. Dresser Mfg. Div., 59 Fisher Ave., Bradford, Pa.

Helpful Data on Well Water Systems

173. A comprehensive, 48-page book on Layne Water Well Systems covers gravel wall wells, underreaming, cemented walls, rock wells and other well types. Applications of shutter screens and vertical turbine pumps are shown, together with water treatment and conditioning equipment. Ten pages are devoted to useful engineering tables and measurement data. Check the coupon today or write Layne & Bowler, Inc., Dept. PW, Memphis 8, Tenn.

Handy Calculator for Cast Iron Pipe

175. With the handy Cast Iron Pipe Calculator you can determine at a glance the class, weight and dimensions of bell and spigot pipe. This slide-rule type calculator is absolutely free. Use coupon or write R. D. Wood Company, Public Ledger Bldg., Philadelphia 5, Pa.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.

Locate Mains and Services Without Digging

185. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

How Your Filter Washing Can Be Improved

188. More thorough sand washing with the elimination of mud balls and cracking with resultant longer filter runs are claimed for the Palmer Filter Bed Agitator, described in bulletins issued by the Palmer Filter Equipment Co., P. O. Box 1655, Erie, Pa.

Sealed Repair for Broken Mains

203. Damaged water mains can be quickly and permanently repaired with Skinner-Seal split coupling clamps. Special gasket and clamp design withstands full fire-fighting pressure. For 2" to 16" pipe. Get details on this and other clamps from M. B. Skinner Co., Dept. PW, So. Bend 20, Ind. Check coupon now.

Does Your Water Works Have Standby Power?

234. Dependable Climax power plants are ready for emergency service to insure fire protection, and can also save power costs by peak load operation. Use the coupon for full data on Climax, 40 to 495 HP, operating on sewage or natural gas, butane or gasoline. Climax Engine & Pump Mfg. Co., 208 So. La Salle St., Chicago 3, Ill.

Investigate This Compact Flow Meter for Water

226. The Foster "Flow Tube" is a new metering element that is compact and easy to install. Bulletin FT illustrates simple element containing nozzles for differential pressure production and shows capacity range and accuracy. Made in standard type sizes. Foster Engineering Co., Union, N. J. will send copy, or use coupon.

Design Data for Hardness, Turbidity, Color or Algae Removal

253. Bulletin No. 9041 published by The Dorr Co. furnishes design data on the Hydro-Treator for high-rate, upflow type treatment of municipal and industrial water supplies. 32 pages include distinguishing features of the unit, types and sizes, capacity ratings and typical operating results. Get your copy of this helpful bulletin by using coupon today. The Dorr Co., Barry Pl., Stamford, Conn.

Book Tells How to Control Algae

257. A booklet giving details on the control of various microscopic organisms frequently found in water supplies is offered by Phelps Dodge Refining Co., Dept. PW, 40 Wall St., New York 5, N. Y. Check coupon for your copy.

Have You Investigated The Chlorinizer?

273. Be sure to check the Builders-Providence "Chlorinizer" wherever chlorine gas is to be used. Wide range of metering for delivery of chlorine-water solution; long life control valve; safety features and many other points are covered in bulletin 840-G27, available from Builders-Providence, Inc., 356 Harris Ave., Providence 1, R. I. Check the coupon for your copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co., Burlington, N. J. Get your copy by checking the coupon.

Corrosion Protection For Water Works

280. Steel pipe lines, elevated tanks, treatment plant equipment and all other steel structures subject to rust, tuberculation and attack by aggressive soils can be protected by long-lasting Bitumastic enamels. Send for bulletins today so that you can specify the right coating for your job. Use coupon or write Koppers Co., Tar Products Div., Dept. 555T, Pittsburgh 19, Pa.

FREE

to WATER WORKS and SEWAGE MEN

HOW TO CONTROL ALGAE

"The Use of Copper Sulphate in Control of Microscopic Organisms" by Dr. Frank E. Hale (former Director of Laboratories, Dept. of Water Supply, City of New York) is an authoritative work concerning the control of micro-organisms and elimination of tastes and odors. Describes in detail methods of controlling various forms of microscopic life commonly encountered in water supply systems. Contains descriptive material, plus 48 photo-micrograph studies of organisms discussed.

ROOT AND FUNGUS CONTROL

"Copper Sulphate for Root and Fungus Control in Sanitary Sewers and Storm Drains," by John W. Hood, contains information published for the first time. This material includes actual methods for control and operating procedure. Here's the book that is a "must" for all sewage men.

GET EITHER OR BOTH OF THESE BOOKLETS ABSOLUTELY FREE— These two valuable booklets, so important to all water works and sewage men, are yours *without obligation.* Mail coupon below!

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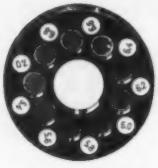

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Hellige Glass Color Standards are safely mounted in unbreakable plastic frames. They are more convenient and economical. They never fade or change, THEY NEVER FAIL.

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Versatile Maintainer Has Year 'Round Usefulness

151. A new bulletin shows how the sturdy Huber Maintainer will work for you the year 'round on maintenance jobs, berm leveling, road planing, bull-dozing, snow plowing, brooming, mowing shoulders and as a patch roller. Good ideas on how to do all these jobs in Bulletin No. M-138. Write Huber Manufacturing Co., Dept. PW, Marion, Ohio.

The Easier Way For Pavement Breaking

220. Rapid Pavement breaking the low cost way is described in bulletins issued by the R.P.B. Corp., 2751 East 11th St., Los Angeles, Calif. Both "Mighty Midget" and heavy-duty truck-mounted models make quick, clean cuts, break trench openings or tamp backfill. Use coupon for full data.

Design Data on Universal Concrete Cribbing

274. Complete information on concrete cribbing for embankment retaining walls, bridge abutments, highway underpasses and other structures will be found in a new bulletin issued by the Universal Concrete Pipe Co., 297 S. High St., Columbus, Ohio. Check coupon for free copy.

CIVIL DEFENSE

Air Cooled Engines for Hundreds of Applications

137. Tested under severest conditions of long, hard use, these engines have earned world wide recognition as the "right" power for hundreds of applications. Get latest bulletin from Dept. PW, Briggs and Stratton Corp., Milwaukee 1, Wisc.

Protection Against Power Failure

149. Data on stationary, portable, and standby electric plants, AC and DC, are offered by D. W. Onan & Sons, Inc., 7653 University Ave., Minneapolis 5, Minn. Several bulletins cover diesel and gasoline-driven plants for every purpose. Just check the coupon for your copies.

Emergency Water Supply and Treatment

184. The mobile Pur-O-Pumper diatomite filter and portable dual drive hypochlorinator, both supplied by Proportioneers, Inc., team up for emergency water supply treatment. Pump and diatomite filter with 50 gpm capacity are trailer mounted, gasoline operated. Get all the facts from Proportioneers, Inc., 356 Harris Ave., Providence 1, R. I., or use coupon.

Electric Equipment For Rescue Work

185. Homelite Carryable gasoline-engine-driven generators will supply light in all emergencies and plenty of power to operate the self-priming pumps, blowers and chain saws used by rescue teams. Get full data on these units by checking coupon or write Homelite, Inc., Dept. PW, 2103 Riverdale Ave., Port Chester, N. Y.

Two-Way FM Radio Telephone Equipment for All Departments

197. The benefits of two-way radio communciation for all departments of municipalities and counties make full information on this subject important to all engineers. For descriptions of Motorola FM systems, or for specific recommendations concerning your application write to Dept. PW, Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.

Emergency Chlorination and Main Sterilization

213. Get data on portable emergency chlorination units designed to save time in cases of broken mains or substitute water supplies. Use coupon to order copies of publications 22-C; 58-C; and 408 from Wallace & Tiernan Co., Newark 1, N. J.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, 327 Fifth Ave., Pittsburgh 22, Pa. Check the coupon and we will forward your request.

How to Keep Trenching Jobs on Schedule

24. The easy maneuverability of the tough, compact Cleveland Model 95 "Baby Digger" makes it well suited for the difficult job of trenching past the many obstacles of city and suburban work. Multiple digging and crawler speeds handle all soil types and trench widths up to 24". Get Bulletin S-52 from Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

A Handbook of Sewer Cleaning Equipment and Methods

46. A new, fully illustrated 40-page booklet shows every sewer cleaning operation with "Flexible" tools. Includes data on the fast and easily operated new Sewe RodeR and full engineers' specifications for power bucket machines. For your copy write Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.

Standard Forms for Concrete Pipe

67. Concrete pipe for sewerage, drainage and culvert projects can be produced quickly and uniformly with Quinn Standard concrete forms. Data on forms for 12" to 96" tongue and groove or bell end reinforced pipe from Quinn Wire and Iron Works, 1621 12th St., Boone, Iowa.

Engineering Facts About Transite Pipe

83. This compilation of Johns-Manville's "Engineering Facts" series presents concise, factual information about Transite's many economic and engineering advantages, and includes informative case histories plus dimensions and data for your files. Write Johns-Manville, Box 290, New York 16, N. Y., or use the handy coupon.

Using Sewage Sludge Gas For Power Generation

90. Fairbanks-Morse dual fuel engines can operate on either sludge gas or oil to provide steady power output despite fluctuations in gas supply. Bulletins are available on several sizes to meet your needs. Write, giving exact requirements to Fairbanks, Morse & Co., Dept. PW, 600 So. Michigan Ave., Chicago 5, Ill., or use handy coupon.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., 200 Eliot Street, Fairfield, Conn

Comminutors for Automatic Disposal of Coarse Sewage Solids

152. The problems connected with disposal of coarse sewage solids are eliminated by clean, odorless, automatic Comminutors. Full engineering data show the proper model for every size plant and furnish details of hydraulics and typical installations. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors and other related units. Photos and drawings of installations plus capacity tables complete this valuable booklet. Use coupon or write Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

Data Offered On Mixed Flow Pumps

201. Data on the complete line of Worthington Mixflo pumps of the two-vane, non-clogging sewage type is offered in 16-page bulletin W-317-H16. Salient features are outlined, typical sections, performance curves and general data for five types are included. Helpful charts aid shafting selection. Copies available by using coupon or from Worthington Pump and Machinery Corp., Harrison, N. J.

Data on Design of Grit Collectors and Washers

202. Grit collection and separation of organic materials from settled grit is described in Link-Belt Bulletin 1942. Typical installations are shown, and design data is provided, together with specifications. Use coupon for copy, or write Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Tractor-Mounted Backhoe Simplifies Digging Operations

238. Be sure to investigate the new Henry Backhoe to cut digging costs on laterals, footings, septic tanks, graves. Easily attached to your tractor. Get full data from Henry Mfg. Co., Dept. PW-751, Box 720, Topeka, Kansas, by using coupon.

How Sewer Departments Clean Catch Basins Faster

245. Cities using Hydrocranes for catch basin cleaning report better, faster, cleaner jobs. Additional excavation jobs keep these versatile units busy. Send for full data today by using coupon. Bucyrus-Erie Hydrocrane Div., So. Milwaukee, Wis.

General Catalog on Measuring and Controlling Equipment

272. The full line of Simplex equipment for the measurement and control of liquids and gases in water and sewage plant installations is illustrated and described in detail in 28-page Catalog 002. Every engineer should study the design data in this helpful booklet. Write Simplex Valve & Meter Co., 68th & Upland Sts., Philadelphia 42, Pa., or use the coupon.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy coupon or write Combustion Engineering-Superheater, Inc., Flash Dryer Div., 200 Madison Ave., New York 16, N. Y.

REFUSE COLLECTION AND DISPOSAL

Efficient Material Handling to Reduce Incineration Costs

130. Blaw-Knox Buckets specially designed for refuse and garbage handling are described in 22-page Bulletin 2350. Illustrations show progress of material through a modern municipal incinerator plant. Dimensions and incinerator bucket specifications are included. Blaw-Knox Div., 2124 Farmers Bank Bldg., Pittsburgh 22, Pa.

Save Garbage Collection In Defense Housing

232. Defense housing projects won't drain manpower garbage collection when Westinghouse Waste-Away Food Waste Disposers are installed in each kitchen. Helpful information for community planners is offered by Westinghouse Electric Corp., Electric Appliance Div., Mansfield, Ohio. Just check the coupon.

Thinking of Sanitary Landfills? Get This Booklet Now

131. One of the most informative descriptions of the sanitary landfill method of garbage and refuse disposal is presented in Caterpillar's 16-page booklet "A Look to the Future with Sanitary Landfill." The booklet is designed to serve as a guide to proper site selections, the choice of the right equipment to do the job, and the actual operations of sanitary fill. Pictorial treatment shows how and when to start such a program, what to look for in a site, benefits received by the community, and other important considerations. Published by the Caterpillar Tractor Co., Peoria 8, Ill. Check the coupon for your copy.

City-Wide Planning for Dual Waste Disposal

243. You can get full details on the General Electric "Disposall" plan for garbage elimination by converting food wastes to sewage. Learn how Jasper, Ind., eliminated garbage cans and collection nuisance with electrical disposal units by checking handy coupon. General Electric Co., Bridgeport 2, Conn.

Lay bigger tonnage, yet cost 50% less

Up to 12" thickness in widths to 11', lesser thicknesses to 12'6"

JAEGER Paver-Type Aggregate Spreaders

Cost half the price of bituminous pavers. Efficiently lay both base and surface aggregates, free-flowing bituminous mixtures, plant-mixed stabilized soil. Crawler or 4-wheel drive operates on subgrade, not on new-laid material. Two models, to work with all sizes of trucks.

Lay both base and top of parking areas, drives, secondary roads: Any free-flowing bituminous material or macadam surface.

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The original and most widely used plasticized sulfur jointing material, for joining bell and spigot cast iron pipe. Economical — High Quality.

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A precast rubber packing for caulking all size bell and spigot cast iron pipe.

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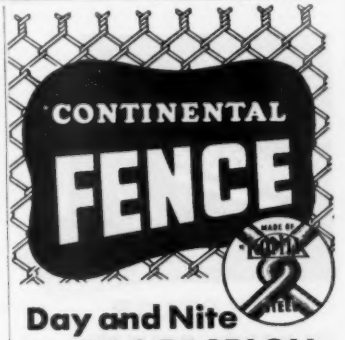

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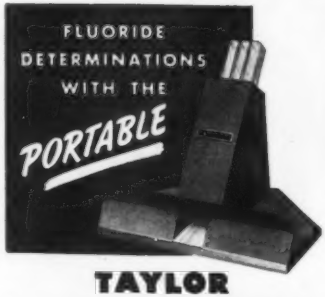

TAYLOR WATER ANALYZER

You can make on-the-spot determinations of fluoride concentrations in municipal water supplies with the Taylor Water Analyzer. Fluoride slide gives readings from 0 to 1.6 p.p.m. from a single slide containing all necessary color standards. No fragile, expensive Nessler tubes to handle. No danger of inaccuracies since all color standards *carry an unlimited guarantee against fading.* Complete set includes base, slide and three sample tubes. Slides for pH, chlorine, silica, iron content and many more can be used on same base.

FREE BOOKLET! Write today for your free copy of "Modern pH and Chlorine Control". 96 pages of valuable data on water analysis and treatment for water and sewage plant operators. SEE YOUR DEALER FOR TAYLOR EQUIPMENT.

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WORTH TELLING . . .

by Arthur K. Akers

★ **Infilco Inc.**, completes the removal of its executive and engineering offices to Tucson, Ariz., with the setting up of its advertising department there under **Norman H. Tripplehorn.**

★ One of the best publications yet seen on Civil Defense Communications is issued by that title by **General Electric.** Get yours from Dept. N-5, G. E. Advertising Division, Electronics Park, Syracuse, N. Y.

★ **Carl C. Walker,** president of the Engineers Club, Columbus, Ohio, is chairman of the Board of Judges for the Eschenbrenner Awards offered senior civil engineering students by **Universal Concrete Pipe Company. David L. Crowson** (Florida) and **Frank M. Masters Jr.** (Penna.) are the first two winners.

Mr. Walker

Mr. Zino

★ **Joseph Dixon Crucible Company** announces **Anthony J. Zino, Jr.** as domestic sales manager at Jersey City.

★ NATION'S BUSINESS of January carried an interesting story on **Wallace and Tiernan** titled "The Men Behind Safe Water." Reprints available from W. & T.

★ **W. H. Shank** isn't even staggering under the added burden of public relations work, assumed on top of the advertising managership of **Hardinge Company Inc.,** York, Pa.

★ **Bryan Hendershott,** assistant to the president of **Kerrigan Iron Works,** of New York, Chicago, and Nashville, is now with the Street and Highway Lighting Industry Advisory Committee, helping with NPA matters. Also, **Eugene C. Clemens,** of the **Cannelton Sewer Pipe Company,** is that industry's NPA consultant.

★ **Allis-Chalmers'** news includes election of **W. A. Roberts** as president; **Boyd S. Oberlink,** vice president; and **W. G. Scholl,** general sales manager, tractor division.

★ **Link-Belt Company** is building a new plant at Colmar, Pa., supplementing the Nicetown one in Philadelphia, where we hope **Col. Joe Gilbert** will remain: he's easier to get to there!

★ **Caterpillar Tractor** has inaugurated a big training program covering three schools for Army Corps of Engineers personnel. 90 men started in it in June.

★ **The MacBeth Corporation,** Newburgh, N. Y., has acquired a second plant there as increased manufacturing capacity for pH meters, electronic, and optical instruments.

★ The Case for Heavy-Duty Trucks" is the intriguing title of a handsome new booklet just published by **Autocar Company,** Ardmore, Pa. They make a good case, too.

★ Investment of a million and a half dollars in plant expansion at Connersville, Indiana, by the **Roots-Connersville Blower Corporation** is announced by **John B. O'Connor** executive vice president of Dresser Industries, Inc., Dallas, Texas.

★ As we go to press, the largest and undoubtedly the liveliest meeting ever held by the National Industrial Advertisers Association is in progress at the Waldorf-Astoria in New York. For best talks at it so far, we nominate **Paul C. Bunker's** of **Foxboro Company** and **Charles E. Wilson's,** director of Defense Mobilization.

★ Lawyer, reading a client's last will and testament to a circle of expectant relatives: "And so, being of sound mind, I spent every cent I had before I died."

SERVICE CONNECTIONS are no problem in LOCK JOINT Reinforced Concrete CYLINDER PIPE

★ FITTINGS AND EQUIPMENT NECESSARY FOR MAKING SERVICE CONNECTIONS

HOW TO TAP

1. Remove concrete down to cylinder in area to be tapped.
2. Assemble fittings around bars of reinforcing cage, drawing gland down firmly so that gasket fits tightly against cylinder.
3. Mount tapping drill on corporation stop and tap.
4. When tap is completed, protect steel fittings with a cement mortar encasement.

Making a service connection under pressure in a Lock Joint Reinforced Concrete Cylinder Pipe is that simple.

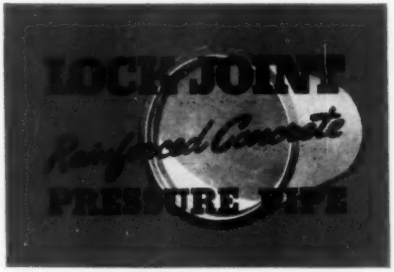
Yet with these few steps a foolproof tap is always achieved. There can be no cross-threading, no loss of alignment and no damaging of the pipe with attendant costly shut-downs and repairs.

Lock Joint Pipe Company will be glad to furnish, at nominal cost, the few fittings necessary to make service connections from ¾" to 2" in diameter in any pressure pipe of Lock Joint design. Fittings are also available for making large diameter flanged connections—with ease under pressure. For illustrated instructions on tapping any type of Lock Joint Pressure Pipe, write for booklet, "Tapping Lock Joint Pressure Pipe Under Pressure."

LOCK JOINT PIPE COMPANY
Est. 1905
P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS:
Wharton, N. J., Turner, Kan., Detroit, Mich.

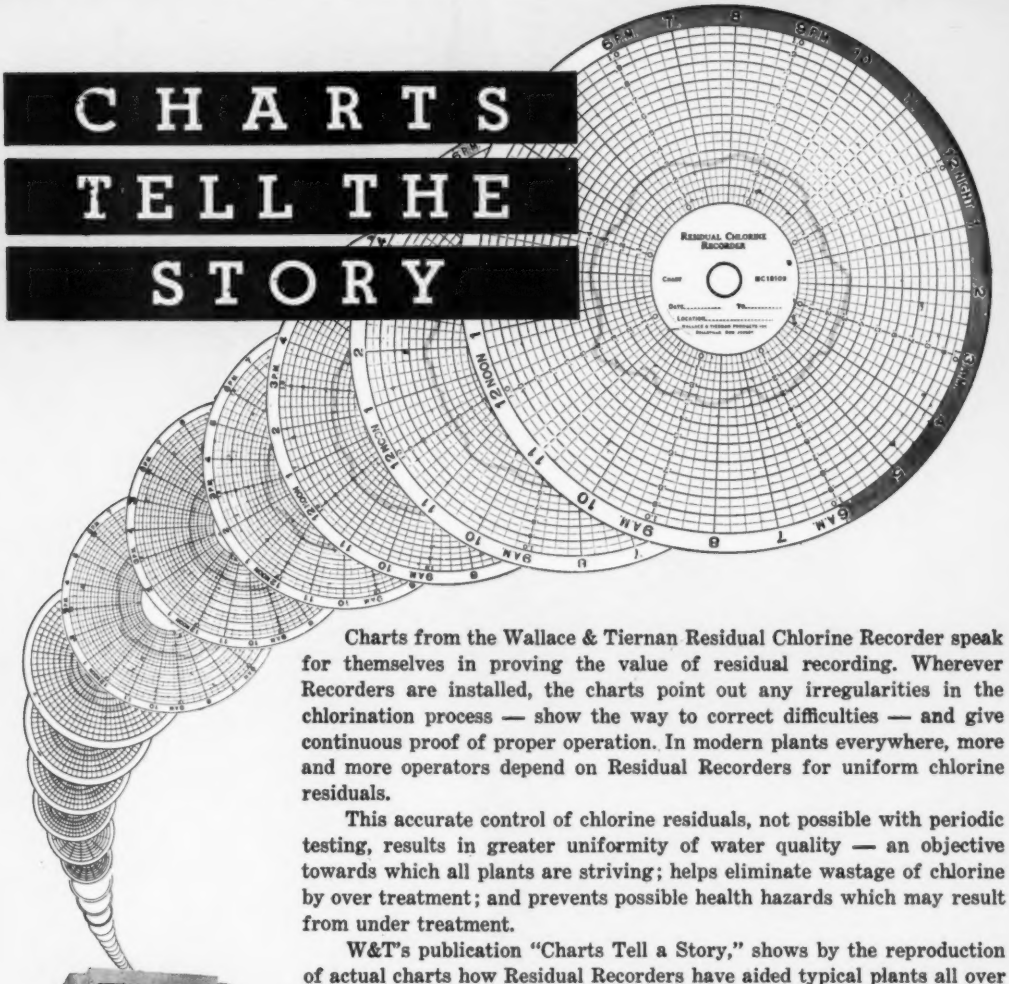
BRANCH OFFICES:
Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Valley Park, Mo. Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. Tucumcari, N. Mex. • Oklahoma City, Okla. Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R.



SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

CHARTS TELL THE STORY



Charts from the Wallace & Tiernan Residual Chlorine Recorder speak for themselves in proving the value of residual recording. Wherever Recorders are installed, the charts point out any irregularities in the chlorination process — show the way to correct difficulties — and give continuous proof of proper operation. In modern plants everywhere, more and more operators depend on Residual Recorders for uniform chlorine residuals.

This accurate control of chlorine residuals, not possible with periodic testing, results in greater uniformity of water quality — an objective towards which all plants are striving; helps eliminate wastage of chlorine by over treatment; and prevents possible health hazards which may result from under treatment.

W&T's publication "Charts Tell a Story," shows by the reproduction of actual charts how Residual Recorders have aided typical plants all over the country.

Why not write for your copy today — or call your W&T Engineer — to see how residual recording can help in *your* plant, too?

WALLACE & TIERNAN
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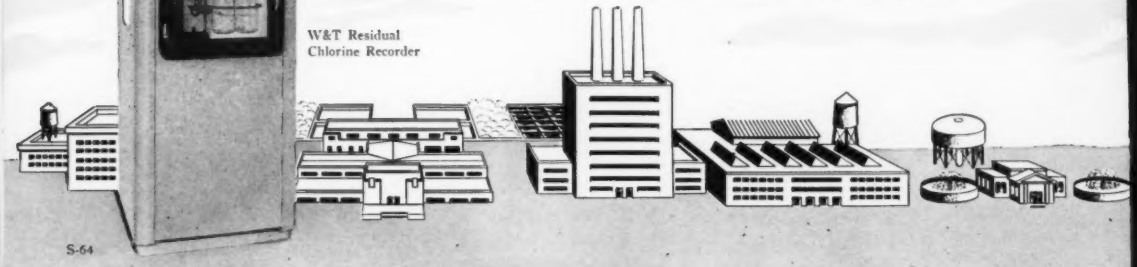

W&T Residual
Chlorine Recorder

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